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An Examination of the Gender Disparities in Receiving Diabetes-specific Healthcare Services

By

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B.A., Philosophy, Georgia State University, 1999

MPH, Georgia State University, 2013

A Dissertation submitted to the Graduate Faculty of Georgia State University in partial fulfillment of the  
Requirements for the Degree of Doctor of Philosophy, Public Health

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May, 2017

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## **Abstract**

*Background:* Diabetes is one of the most common and pernicious chronic illnesses. Guidelines recommend visiting a physician for the secondary prevention of complications. Many risk factors and barriers exist, which hinder healthcare usage. Males are at higher risk for many health issues, including diabetes, yet research shows that women are more likely to receive preventive services. The purpose of this study is to examine whether putative risk factors and barriers to care are diabetes-specific and whether their impact varies by gender.

*Methods:* The Behavioral Risk Factor Surveillance System was used to assess disparities between genders related to diabetes-specific care. In addition, logistic regression was used to determine whether barriers to healthcare, such as education, lack of health insurance, and out-of-pocket-costs, were also diabetes-specific; and did they significantly vary by gender.

*Results:* Analyses demonstrated that males were less likely to visit the physician for their diabetes care. Results indicated that while there were main effects for the additional barriers, they did not vary by gender. Within-groups analyses showed that the odds of not receiving adequate care for those with a lack of insurance were greater for males.

*Conclusion:* Results demonstrated that in many instances, both gender and the chosen barriers increased the odds that individuals would not receive the optimum level of care, although not varying by gender. The lack of an insurance plan was shown to reduce the likelihood that males would receive the appropriate care. These findings potentially aid in the development of more gender-specific interventions and policies.

## **DEDICATION**

I would like to dedicate this dissertation to my wife, Emily B. Jackson, PhD., who has offered undying support, encouragement, and advice through every step of the process. Thank you for your example and guiding words, without which I would not have made it through. I would also like to extend a very special thanks to my Mother, Gail Jackson, Father, Charles Jackson, and sister, Amanda Brown, for their support. And last but not least, this dissertation, and all of my future work, is dedicated to the communities, whose health we hope to improve. We are ALL public health.

## ACKNOWLEDGEMENTS

I would like to acknowledge the staff, students, faculty, and research participants I have met during my graduate school experience and who have played an integral role in my success. From the staff sending out notifications to those handling the graduation events (specifically Jessica Pratt and Gina Sample), their quality work and patience serve as a network of professionals who facilitate the smooth matriculation of large bodies of students. Students are the lifeblood of any university program and there are too many to mention here whom I have met along the way who I have benefited from knowing. Dr. Kate Guasteferro and Michael Bryan, PhD. (c) deserve a special mention, however, as their friendship and academic excellence provided me with support and inspiration. There are several faculty in the School of Public Health who have been instrumental in the completion of my degree. First and foremost, Dr. Shannon Self-Brown has been an excellent mentor, both academically and professionally. She has been there every step of the way answering questions, fielding frustrating phone calls, and offering career advice. This project would not have been completed without her help. Others in the SPH, such as Drs. Sheryl Strasser, Rodney Lyn, Kim White, and Laura Salazar have all been sources of advice and support since I began my MPH and still come through whenever asked. Non-SPH faculty, both Drs. Angie Snyder (GAHPC) and Xuanping Zhang (CDC), were gracious enough to accept an invitation to serve as committee members. Both have given exemplary academic and professional assistance at every step of the process and this would not have been as educational and beneficial without their participation. -A most heartfelt thanks to those I have mentioned and those I may have forgotten.

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## Introduction

Diabetes is a chronic illness affecting millions of Americans. It is the seventh of the top 10 leading causes of death in the United States (Centers for Disease Control & Prevention, 2016). Billions of dollars in healthcare costs, as well as indirect costs (loss of productivity, etc.), have engendered nationally political, and local public health, movements aimed at alleviating the burdens associated with diabetes and its complications (Centers for Disease Control & Prevention, 2017). One of the most successful ways to alleviate the burden is to ensure receipt of proper preventive services, which for this study will comprise physician visits. However, there are several risk factors and obstacles that may impede an individual's ability to seek or participate in proper care: gender<sup>1</sup>, insurance coverage, education level, and out-of-pocket costs, are a few of the most commonly accepted. The World Health Organization's, Committee on Social Determinants of Health socioecological model states that these, as well as other, factors can impede access to preventive care ("WHO | Commission on Social Determinants of Health - final report," n.d.). While they are often cited as impediments to preventive services and chronic illnesses writ large, more could be done to understand how they are specifically related to diabetes care. Although many projections have been made, scientists speculate that if current trends continue, the number of people in the United States diagnosed with diabetes will increase by 165% by 2050, from 11M in 2000 to over 29 million (Boyle, Thompson, Gregg, Barker, & Williamson, 2010). A better understanding of how best to increase preventive services could help mitigate the effects of this rise in prevalence and incidence.

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<sup>1</sup> The data set – the Behavioral Risk Factor Surveillance System – assesses the gender or sex of the interviewee by allowing the interviewer to make a judgment call regarding whether the respondent is male or female. Within the actual data, male or female is treated as the "sex" of the respondent. However, due to the fact that neither the individual's preferences are assessed regarding gender, nor are there biological tests to consider sex, gender and sex are used interchangeably through

In addition to these barriers, gender has also been cited as a risk factor for the less than optimal receipt and/or use of healthcare services (Griffith, 2016). It has been shown, for example, that women typically seek and/or receive more healthcare services than men (Vaidya, Partha, & Karmakar, 2012c). Consequently, the question of how the above-mentioned barriers to access might be affected by gender is a largely unanswered one. The current study aims to begin answering some of these questions and based on the study's conclusions, offer guidance for policy makers and intervention strategists.

## CHAPTER 1

### **Statement of Purpose**

The purpose of this research is to examine and explicate the role of gender in the receiving of healthcare services, which for the purposes of this study will be diabetes-specific physician's visits. Specifically, this study will examine whether disparities exist for men in the receipt of such services, and whether gender serves as a risk factor to those seeking/receiving preventive services, in addition to the 3 recognized barriers to care: 1) out-of-pocket costs, 2) presence/absence of insurance coverage, and 3) education level. Results from this research can serve as guidance for policy makers and intervention strategists focusing on the reduction of this significant public health problem.

## **Diabetes Public Health Burden**

### **Diabetes**

Diabetes is a group of diseases that can harm the human body in several ways, depending on type and severity of the condition (National Institute of Diabetes and Digestive and Kidney Diseases, 2016). Patients with diabetes, regardless of type or severity, are encouraged to visit a physician in order to ensure their condition remains under control (Drive, 2016). The following is a discussion of the myriad types of diabetes and its complications, which will demonstrate a need for physician's visits. The population of interest for this research will be those who have a previous diagnosis of diabetes, which requires attention be paid to secondary prevention regarding those complications resulting from diabetes.

Diabetes diagnoses are separated into two types, Type 1 and Type 2. Type 1 diabetes is typically found in children and can be managed with the help of insulin and other (ADA, 2017). Even though type 1 diabetes, often called "juvenile-onset" diabetes, due to the majority of cases beginning in childhood, accounts for only 5% of those with diabetes ("National Diabetes Statistics Report, 2014 - national-diabetes-report-web.pdf," n.d.), the burden this disease causes for patients diagnosed is significant.

There has been a global increase in type 1 diabetes, with no explanation as to why (Eggo, 2013). This is particularly alarming when considering the myriad ways in which type 1 affects quality of life in those suffering from the condition. Type 1 has been associated with several deleterious conditions in patients throughout the lifespan, including cardiovascular disease and hypoglycemia (Maahs, West, Lawrence, & Mayer-Davis, 2010). Researchers have studied this condition in populations in different phases of development to understand more about how quality of life is impacted. For instance, a recent study from China found that children with type 1 diabetes are more likely to experience depressive symptoms associated with diabetes management (Guo et al., 2015), due to an inability to adjust to the

treatment requirements related to managing their condition. Research on adolescents who have recently graduated high-school found connections between better diabetes self-management and higher quality of life scores (Hanna, Weaver, Slaven, Fortenberry, & DiMeglio, 2014). That is, those who were able to better manage their condition scored higher on quality of life indexes. This trend continues as adolescents grow into adults.

There are several reasons type 1 remains an issue for adults. For one, even though it is often referred to as juvenile onset, adults can develop the condition (“A Focus On Adults With Type 1 Diabetes,” 2011). Type 1 is also difficult to diagnosis in adults due to misconceptions about when it is first contracted; that is, it only occurs in children and adolescents (Tsai, 2015). Issues with type 1 diabetes are further complicated by *latent autoimmune diabetes in adults*, a condition that demonstrates characteristics of both types 1 and 2, which makes it more difficult to diagnose either condition (“Type 1.5 Diabetes,” 2006).

The priority population of this research is adults with a diabetes diagnosis, but as can be seen, children with type 1 develop into adults with the condition. These adults will still require physician’s visits in order to help manage their condition. This fact is illustrative of the reasons why type 1 remains an issue. That is, not only is type 1 related to a wide variety of poor health outcomes, it also plays a significant role in healthcare expenditures. Unfortunately, types 1 and 2 are rarely segregated in studies related to cost, making it difficult to delineate disparities in cost burden. Research has shown, however, that those suffering from type 1 pay a disproportionate amount of the health expenditures related to diabetes (Tao, Pietropaolo, Atkinson, Schatz, & Taylor, 2010).

Type 2 diabetes is different from type 1 in several ways. Type 2, for example, accounts for many more cases of diabetes than type 1; that is, 95% of the cases of diabetes in the United States are type 2 (National diabetes report – web, 2014). Type 2 diabetes is also often referred to as “adult-onset” diabetes due to the majority of cases being adults (PubMed Health, 2014), although research has shown



children can also be diagnosed with type-2. (D’Adamo & Caprio, 2011). Many of those with type 2 are able to ameliorate their condition through simple lifestyle changes such as healthier eating and increased exercise. The Diabetes Prevention Program, for example, an intervention created and conducted by the National Institute of Diabetes and Digestive and Kidney Diseases (“Diabetes Prevention Program (DPP) | National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK),” n.d.) – which has, as its three main components: diet change, increase physical activity, as well as behavioral modification – has been shown to reduce diabetes incidence rates by 34% during the 10-year follow-up (“10-year follow-up of diabetes incidence and weight loss in the Diabetes Prevention Program Outcomes Study,” 2009). This research demonstrates that type 2 diabetes is amenable to prevention, which might be accessed through a physician’s visit as well as other venues. Yet, even with this success, type 2 remains a significant contributor to healthcare expenditures in the United States.

While costs, as well as complications, can be difficult to assess by type, the numbers elucidate the enormous public health burden posed by diabetes; which, for the purposes of this research, refers to either condition diagnosed by a physician. There are three primary complications often discussed in the diabetes literature, which contribute to negative health outcomes as well as increased public health expenditures in the US. First, Diabetes contributes significantly to several costly conditions, which can hinder the individual’s health. These complications are often separated into *microvascular* (diabetic nephropathy, neuropathy, and retinopathy) and *macrovascular* (coronary artery disease, peripheral arterial disease, and stroke (Mehravar et al., 2016), (Fowler, 2008). Diabetics, for example, are at higher risk for kidney failure (“Diabetes - A Major Risk Factor for Kidney Disease,” 2015). Research has shown that not only are those with diabetes at an increased risk of end stage renal disease (ESDR), it is the primary contributor to ESDR (43%) (“Kidney Disease of Diabetes - kdd\_508.pdf,” n.d.). There is widespread tracking of ESDR due to ESDR’s prevalence in the aging populations. The most recent numbers show that this one condition costs Medicare \$31 billion a year (“Medicare’s high cost end stage

renal disease patients,” 2011). This condition, as well as others, places a significant strain on the United States’ healthcare system.

Second, diabetes is a contributor to other costly conditions such as lower extremity limb amputations (LEA). Diabetes sufferers can develop foot issues resulting from nerve damage (neuropathy) caused by their condition. This condition often manifests as numbness or tingling in the feet, which makes it particularly hard to self-diagnose (Ria, 2014). If untreated, this neuropathy can damage the foot – or limb depending on how long it is left untreated - and eventually require that the appendage be amputated, lest the condition spread further. Fortunately, the age-adjusted rates for all levels (toe, foot, below knee, above knee) of lower extremity amputations have decreased over time (“CDC - Age-Adjusted Rate per 1,000 Diabetic Population - Level of Amputation - Data & Trends - Diabetes DDT,” n.d.). Despite these decreases, LEAs remain a costly outcome for diabetes sufferers and society in general. Most recent numbers estimate that LEAs total three billion dollars a year, with each procedure costing approximately \$38,000.00 (Shearer, Scuffham, Gordoio, & Oglesby, 2003). It is clear that from ketoacidosis to LEAs, diabetes poses a significant public health burden.

Finally, retinopathy can also affect the quality of life of the diabetes patient as well as lead to extreme healthcare costs. There are four different types of eye disease related to diabetes, all of which can lead to severe vision loss or blindness (“Facts About Diabetic Eye Disease | National Eye Institute,” n.d.). Latest numbers from the CDC indicate that the percentage of non-institutionalized adults in the US reporting visual impairment related to diabetes has been steady at approximately 9.5% from 1997-2011 (“CDC - Percentage of Adults with Visual Impairment in the Civilian Noninstitutionalized Population - Visual Impairment - Diabetes DDT,” n.d.). Research cited by the Centers for Disease Control estimates that the total cost of vision impairment and loss \$35.4 billion (Rein et al., 2006).

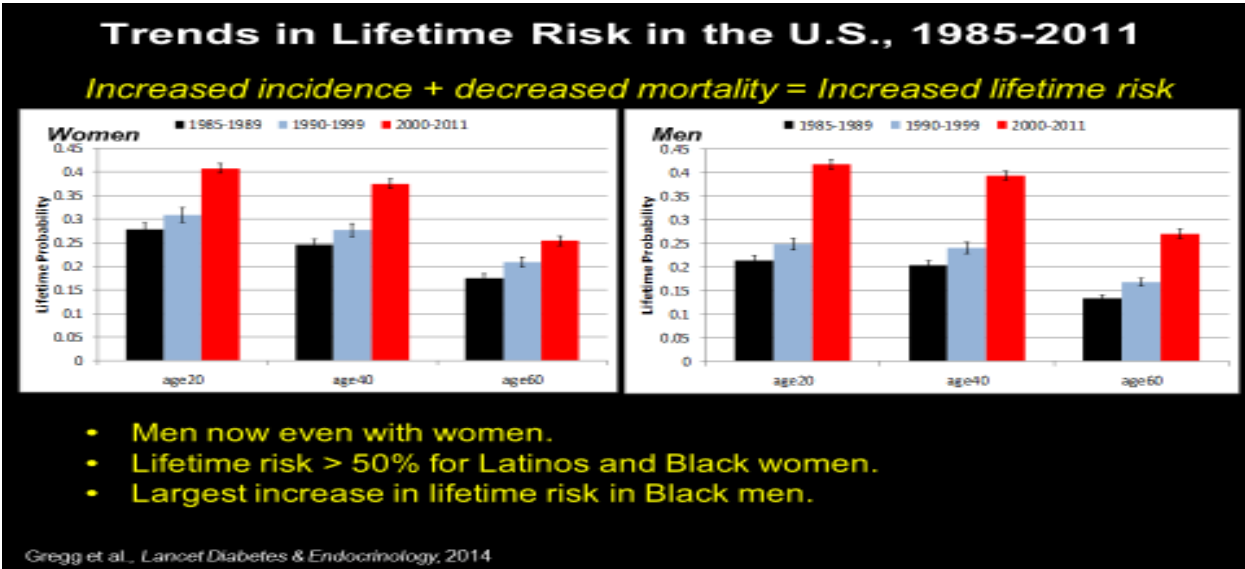
The above research lists a number of complications but is not meant to be exhaustive. Diabetes is associated with other costly conditions such as strokes and acute myocardial infarction. There have been

significant gains in diabetes management in treatment over the last 3 decades resulting in better outcomes for certain portions of the population. It remains, however, a significant contributor to the overall chronic illness burden in the US. That is, 86% of all healthcare spending in the US for the year 2010 (most recent numbers) was for individuals with one or more chronic illnesses (“Multiple Chronic Conditions Chartbook - mcccchartbook.pdf,” n.d.). Diabetes is one of the top 10 causes of death in the US (Centers for Disease Control & Prevention, 2016) and accounts for \$245 billion in healthcare spending, with \$176 billion in direct medical costs and \$69 billion in decreased productivity (Ria & 1-800-Diabetes, n.d.). The magnitude of spending poses significant challenges to the United States and places a strain on the healthcare infrastructure, indicating a need to at least mitigate the effects through secondary prevention.

### **Diabetes and gender differences**

Aimed at reducing the burden of diabetes, researchers have demonstrated positive gains in intervention outcomes, which help individuals – and the US’s healthcare infrastructure – better treat diabetes and its complications. Part of this strategy relies on developing appropriate interventions that address a given population’s needs (Sanmartin et al., 2008). An interesting component of diabetes surveillance is the change in risk among men and women. That is, over the last 3 decades, through 2011, male risk for diabetes increased and became commensurate with female risk. Prior to this, women had been at greater risk for diabetes. Figure 1 demonstrates the change in risk between men and women for 3 age groups – 20 YOA, 40 YOA, and 60 YOA – from 1985 to 2011.

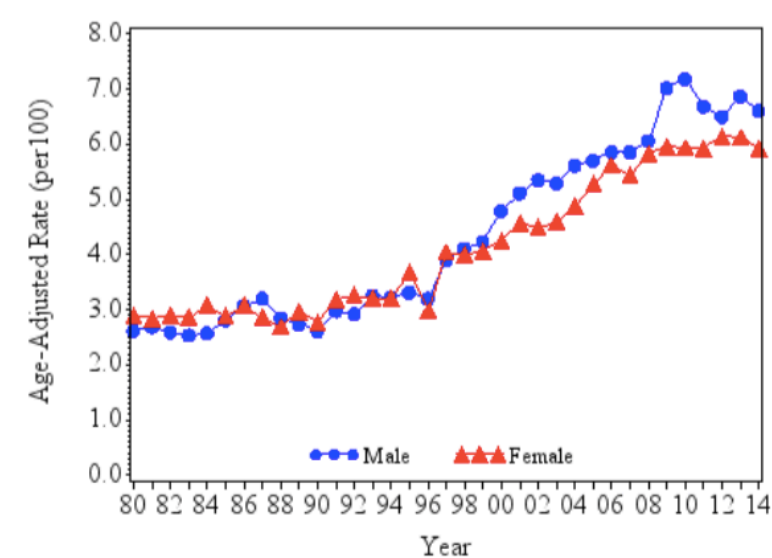
Figure 1. Trends in Lifetime Risk in the U.S., 1985-2011



(Vancouver, Ed Gregg, 2014)

More recent data show that – in some populations – men have now surpassed women as an *at risk* population for diabetes. Figure 2 shows the escalation in risk for men from 1980-2014. Rates demonstrate that men have an increased prevalence of approximately 1 per 100.

Figure 2. Age Adjusted Rates of Diagnosed Diabetes per 100 Civilian, Non-Institutionalized Population, by Sex, United States 1980-2014



Figures 1 and 2 demonstrate a need to focus on the difference between genders when it comes to diabetes research. Diabetes is similar to other chronic illnesses, such as asthma, in that its effects can be mitigated (Stolar, 2010) given the resources; so it is not surprising that those with less access to health education, health literacy, and health care are at higher risk. However, unlike other chronic illnesses, such as asthma – from which 3% more women suffer (“CDC - Asthma - Data and Surveillance - Asthma Surveillance Data,” n.d.) – and coronary vascular disease (CVD) – which women suffer the majority of the burden (Mosca, Barrett-Connor, & Wenger, 2011), diabetes more negatively affects men in the US. These numbers are not meant to conclusively demonstrate that diabetes is completely unique among chronic illnesses, but rather to indicate the complexity of addressing chronic illnesses and gender in the United States. Any attempt at understanding the complex issue of diabetes secondary prevention must take into account the differences in disease incidence, prevalence, and prevention, as well as barriers to prevention, in men and women.

### **Preventive Services: Health Outcomes, Usage rates, & Diabetes**

There are many types of preventive services/techniques for diabetes, which aim at reducing negative health outcomes. The best methods and practices for educating the diabetic on self-management have been codified elsewhere (“National Standards for Diabetes Self-Management Education and Support | Diabetes Care,” n.d.). For the purposes of this research, healthcare services will refer to physician’s visits, specifically for the patient with diabetes. Visiting a physician is one way both men and women can mitigate the effects of any disease. It is common practice, consequently, for medical advice to refer to the importance of visiting a doctor regularly for standard issues such as blood pressure maintenance, weight management, and diabetes (Jones, MD, & MPH, n.d.). Research, although focused on diverse conditions and populations, reveals the need for physicians’ visits in improving

health outcomes. This is good news for diabetes patients, who receive the majority of their care in a physician's office (Champlin, 2014).

Research into access to physicians and its effects on diabetes outcomes has yielded similar results. Researchers examined 540 Medicaid patients to determine if levels of performance on the Primary Care Assessment Tool (PCAT) (Smith & Health, n.d.) correlated with patients' scores on the Health Related Quality of Life (HRQOL) tool ("Health-Related Quality of Life and Well-Being | Healthy People 2020," n.d.). The goal was to assess whether higher levels of qualities such as accessibility, continuity of care, comprehensiveness, community orientation, and cultural competence could improve the patient's HRQOL score. *First contact* is the characteristic of the PCAT measure, which takes into account whether a patient could easily access care. While first contact, as well as most other individual characteristics, was not significantly associated with individual HRQOL measures, the overall PCAT score was; indicating that accessibility plays a part in patient-reported quality of life (Stevens, Shi, Vane, Nie, & Peters, 2015). That is, those participants who could easily visit a physician reported better quality of life.

These findings are commensurate with other research, which demonstrates that patients who can access a physician perceive that they had better quality of life and have better health outcomes; Research examining healthcare services usage writ large, for example, reveals that using those services more often would improve health outcomes (Hadley, 2003). Research has demonstrated that this is true for diabetes patients. Zhang et al. (2012), for example, conducted a study using the National Health and Nutrition Examination Survey (NHANES), which examined whether diabetes patients with healthcare coverage had better diabetes control. The results demonstrated that not only did those with healthcare coverage demonstrate better control outcomes (glycemic control, high non-HDL cholesterol, and low blood pressure), but that those with more healthcare visits demonstrated better outcomes. These findings reinforce previous research, which demonstrates a need for diabetes patients to visit a physician in order

to properly manage their condition; because, as Dr. Zhang et al. pointed out, “Diabetes complications control and management depend on a continuing interaction between healthcare providers and patients” (Zhang, Bullard, Gregg, Beckles, & Williams, 2012).

It is clear that physician’s visits are integral to proper diabetes management. The American Diabetes Association (ADA) (Association, 2016) and Healthy People 2020 (“Diabetes | Healthy People 2020,” n.d.) list several guidelines for proper management, which can only be administered by a trained professional. These include laboratory tests such as *fasting lipid profiles* and urinalysis. Research, such as that cited above, and the recommendations currently listed, have prompted researchers to begin examining methods for facilitating physicians in the practice of what should be “routine medical care” for diabetic patients (Nuti et al., 2015). Visiting a physician can potentially combat disease, facilitate individual prevention habits, as well as reduce costly trips to the ER. Despite these benefits, preventive services are not utilized by those who need them (Vaidya, Partha, & Karmakar, 2012a), which indicates a lot of missed opportunities in the management of diabetes. That is, in addition to the cited health outcome gains, there is money to be saved using preventive services (Owens, 2008).

Yet, despite the proven health benefits, and potential cost savings, healthcare care services usage for both men and women remain low in the United States. One reason for this is the focus that the system puts on treatment versus prevention (“Policy Changes to Improve Health Care Quality | Brookings Institution,” 2001). Moreover, issues of patient awareness, low perceived value of services, and a fragmented financial infrastructure also play a part in the low usage of preventive services (Lambrew, n.d.).

Barriers such as these, as well as those across the access spectrum, prevent patients from receiving the recommended care they need to manage their condition and prevent it from developing into more pernicious and costly conditions. Numbers such as these reveal that diabetes is a costly condition – both in health outcomes and dollars – that already presents the healthcare system with a

substantial burden. Preventive services – physician’s visits – are one tactic for reducing this burden, but usage of these services remains low. One method for ameliorating the burden is to understand the reasons patients are not using the services available. The aim of this research is to better understand these barriers to usage. Addressing these barriers is a daunting effort, but investigating them within the context of theoretical framework facilitates understanding as well as provides an initial step at intervention development. There are several theories, which might apply in this case. The Commission on Social Determinants of Health (CSDH), however, was chosen for its “actionable theorizing” as well as its incorporation of many theories (“ConceptualframeworkforactiononSDH\_eng.pdf,” n.d.).

### **Socioecological Model Approach to Understanding Barriers to Care**

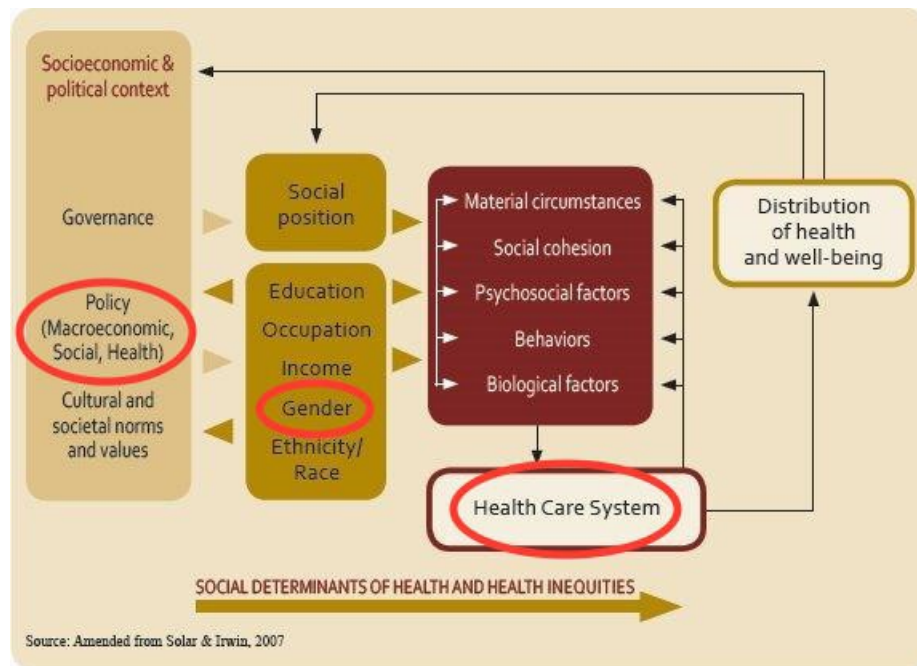
Frameworks often facilitate the understanding of concepts requiring contextualizing into a broader reality. Researchers can glean from particular frameworks solutions they might have missed had they not considered the problem as a whole, often able to see how determinants might be related to one another. The Commission on Social Determinants of Health is one such framework. While an elaborate discussion of the Framework posited by the Commission on Social Determinants of Health (CSDH) is beyond the scope of this research, understanding its purpose and tenets will aid in explaining the importance of this research. The social determinants of health are as varied as the theories that seek to explain them. Social determinants of health can be defined as the, “economic and social conditions that influence the health of people and communities” (Cole & Fielding, 2007). This definition is helpful, but only serves as a starting point for understanding social determinants and the actions that can be taken to mitigate them. The CSDH framework, conversely, adds layers in complexity while also fleshing out the nuances needed to take action.

The purpose, as stated in the document, of the CSDH is manifold and can be lumped into three areas: 1) Improve conditions of daily life, 2) Tackle Inequities, and 3) Measure and evaluate the



problems in order to raise understanding of social determinants. The framework seen in Figure 3 helps elucidate the relationships between individual determinants. The focus of this research will be item #3.

**Figure 3. Adapted from World Health Organization's Conceptual Framework**



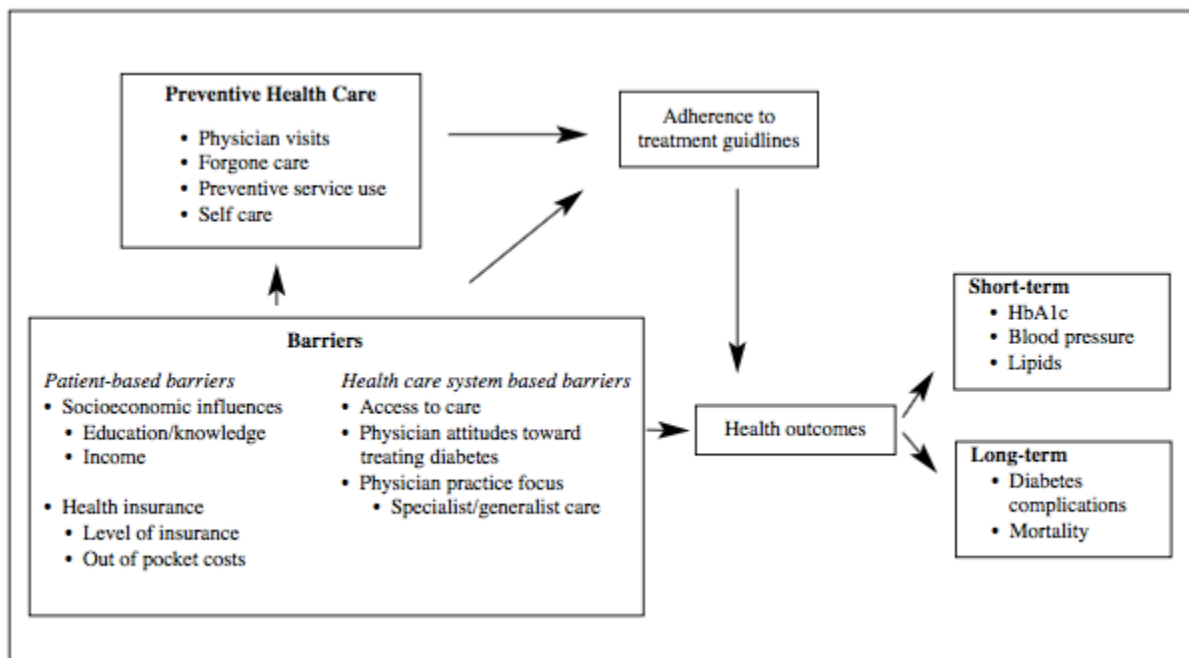
This figure visually delineates how circumstances surrounding individuals influence the inequities in health outcomes between different people. Each red circle represents the category of a determinant investigated in this research.

“Gender,” for example, within this framework, represents a “social stratifier,” which might place one gender at higher risk than the other, depending on conditions and ailments (CSDH framework, pg. 30). The category, “Healthcare system,” also relevant to this research, posits that an equitable system must not only locate the problems amongst the most vulnerable, but also work to understand how the gradients in care affect the individual at all levels of society; such differences that are attributed to access, income, and insurance coverage (Framework CSDH, pg. 30). “Policy” is also circled due to its influence on the aforementioned determinants. In short, the discussion of this framework is not meant to be exhaustive, or a critical, but rather to demonstrate how barriers and/or determinants exist, which affect the health of individuals. The main idea is that if interventionists can identify the determinants and

provide resources, interventions, etc., in order to circumvent the barriers affecting millions of diabetes patients, health disparities can potentially be decreased.

A similar, but more specific (to diabetes) model was developed in order to demonstrate how barriers to care might affect diabetes patients specifically. An area of study of particular interest to both intervention developers and policy makers is related to these determinants and how they affect usage. Acknowledging that there are determinants across the healthcare spectrum – similar to the WHO’s CSDH – Zgibor et al. developed a model for those barriers, which may influence preventive services usage (“External Barriers to Diabetes Care: Addressing Personal and Health Systems Issues | Diabetes Spectrum,” n.d.). Figure 4 shows the external barriers most commonly associated with diabetes-related preventive services usage.

**Figure 4. External Barriers to Care**



This figure elucidates those barriers most commonly associated with care, and begins to pare down the larger determinants spectrum.

Access to care, while sounding singular, is actually manifold, comprising several different factors that might hinder or facilitate preventive services usage. As can be seen, elements such as

education/knowledge, level of insurance, out of pocket costs, and physician attitudes may determine – or, at the very least, influence – whether an individual visits a doctor. For the purposes of this research, “patient based barriers,” such as *insurance coverage*, *education status*, and *out of pocket costs*, will be investigated and discussed.

While these determinants are related in that they all involve financial concerns, they also operate somewhat independently of one another. An individual with insurance, for example, might be more likely to visit a physician. Out of pocket costs for the co-pay may play a role in that decision. In addition, because education level and income make up SES, those with higher SES could potentially be more aware of the consequences of not seeking preventive care. In either case, there is research, which assesses them as a whole and as separate barriers.

### **Gender<sup>2</sup> as Risk Factor for the Lack of Optimum Care**

The CDSOH is illustrative of the comprehensive and complex nature of social determinants of health, while the Zgibor model relates social determinants more specifically to diabetes. Both of these models list gender (sex) as a potential determinant affecting health outcomes, which reinforces the idea that gender affecting health status is not a new idea. Research has demonstrated that gender affects not only the receipt of healthcare services, but the quality of preventive services across a wide spectrum of treatments as well as populations. Research investigating usage among older Americans, for example, revealed that while African-American men were less likely to visit the physician, minority women were less likely to visit the hospital or use outpatient services (Dunlop, Manheim, Song, & Chang, 2002). In addition, a study conducted by Berthold et al. examined the disparities in the control of modifiable risk factors related to cardiovascular health among those with type-2 diabetes between males and females. Results showed that sex played a part in the receipt of proper control. Women, for example, were less

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<sup>2</sup> For the purposes of this research, gender refers to the category each respondent is placed into by the interviewer. While issues of sex, gender, whether biological or one’s personal preference, are important, the limitations of how these data are collected for this survey preclude further investigation. Gender and sex, consequently, will be used interchangeably throughout.

likely to have important biological markers under control; such as A1C levels and systolic blood pressure (Gouni-Berthold, Berthold, Mantzoros, Böhm, & Krone, 2008). Clearly there is a need to examine potential barriers men and women face in receiving the healthcare needed to control their condition. It is evident from the above research that the receipt of care for diabetes patients, as well as the quality of care they receive once at the physician, varies by sex. Understanding why this might be could serve as a first step at creating interventions, which can help mitigate these differences.

Research demonstrates that women are more likely than men to use preventive services writ large (Vaidya, Partha, & Karmakar, 2012b), which indicates men might be less likely to receive diabetes-specific physician's visits. The above cited research, however, indicates that the relationship between *diabetes services* and gender is not always so black and white. Further investigation, consequently, will be useful in testing the assumption that men are less likely to visit a physician due to their diabetes as well as better understanding why.

There are many reasons why disparities exist between males and females when it comes to health. Some of these are biological. Women, for example, are at more risk for *both* health issues as well as not being able to afford the coverage related to reproductive health ("New Women's Health Care Report," 2012). Women also experience more complicated health issues related to their biology (Cylus, Hartman, Washington, Andrews, & Catlin, 2011). This is interesting in its own right, but only answers one part of the question. Research demonstrates that sex alone, that is, cannot completely account of the differences between why men and women utilize preventive services differently (Vlassoff, 2007a).

There are also non-biological reasons why sex might affect the receipt of healthcare services. Men, for example, tend to be under pressure to participate in less health-promotion behaviors and more risk-taking behaviors (Will H. Courtenay, 2000). Men, for example, are socialized to demonstrate strength and stoicism in order to project an impression of dominance and avoid being seen as vulnerable (W. H. Courtenay, 2000). Research has shown, in fact, that perceived ideals of masculinity can affect

healthcare usage (Reynolds, Fisher, Dyo, & Huckabay, 2016). These cultural norms, which affect how men view their illnesses and methods for remedying them might cause them to avoid seeing the doctor, which is a risk factor in of itself. Part of the purpose of this research is to begin unpacking reasons why males might not receive the proper amount of diabetes care, and these theories potentially aid in these efforts.

Several sociological theories exist (Hiebert, Leipert, Regan, & Burkell, 2016), which approach the constructs and perceptions males demonstrate and that affect their decision making, but the theory most informing this research is the biopsychosocial approach (“biopsychosocial model approach definition - biopsychosocial-model-approach.pdf,” n.d.). This approach considers the above as having an effect on decision making, but also takes into account the systems in which the decision maker is approaching his own healthcare. Put another way, while most theories consider the individual agent – and his own conscious decision-making or makeup – to be the most important determinant, the biopsychosocial approach considers this as well as those systems that exist at the top of the continuum. That is, while other theories might approach the problem of healthcare usage by examining those factors unique to men, this approach incorporates elements – such as economic and structural – which are not unique to men (Griffith, 2016).

There are many reasons, as the above demonstrates, why disparities might exist between men and women when it comes to the receipt of diabetes-specific physicians visits. Some of these are biological or cultural, while some are the result of economic and structural barriers. The biopsychosocial approach is used due to its incorporation of all these elements and the nature of this research; external barriers and how gender moderates that relationship. No matter the barrier, research does demonstrate that differences exist.

Research has demonstrated that not only do women use more healthcare; they also cost the system more (Bertakis, Azari, Helms, Callahan, & Robbins, 2000). More recent research reveals that

this trend has continued, especially for government programs, with a large national study indicating that 45% of men use Medicare vs. 55% of women. This disparity is even more pronounced in Medicaid populations where only 32% of eligible men use Medicaid while 68% of women do (24 & 2015, n.d.) (F. 12 et al., n.d.). Women in Medicare and Medicaid are not the only populations to utilize preventive services more than men. Research conducted using the Medical Expenditures Panel Survey (MEPS), which captures individuals who use all payer types (private, public, etc.) found that women used some preventive services significantly more, 52% to 57% compared with 43% to 48% in men (Vaidya et al., 2012a). In addition, gender was found to predict the utilization of preventive healthcare service.

While these numbers reveal a stark contrast in both usage and spending in men and women's healthcare utilization, a large body of work covering this topic has yet to emerge (Vlassoff, 2007b). In fact, as late as 2015, researchers had just begun to include gender as a potential moderating variable in the analysis of health outcomes (Alexander & Walker, 2015). The research presented here illuminates the need for further investigation into the differences between males and females and healthcare usage. The purpose of this research is to examine if men are higher risk for not seeking and receiving diabetes-centered preventive services, but also to assess how this relationship is affected by other known social determinants found within the CSDH and Zgibor model.

### ***Education as Barrier to Preventive Services***

Research specifically focusing on the relationship between *education level* and *level of income* (SES) and preventive services usage has revealed a significant relation. A large longitudinal study, for example, over 31 year period conducted by Lyster et al. (2014), examined the effect SES, among other factors, had on receipt of preventive services related to proper dietary habits and nutrition, as well as those received at a physician's office. Researchers tracked, among other things, the effect that education and income attainment had on cognitive ability and preventive services usage over time. While the effect size was small, there was a significant correlation between SES and preventive services usage; Most

notably, by unpacking income and education, researchers demonstrated that increased education statistically significantly improved the odds of receiving preventive services (Lyerly & Reeve, 2014). Other studies have also found that education level directly impacts preventive services for health issues including pap tests among women (Coughlin, King, Richards, & Ekwueme, 2006) and that income directly impacts whether an individual has a primary care doctor and receives preventive services (Lasser, Himmelstein, & Woolhandler, 2006). Further understanding, however, for these associations among diabetes patients is warranted. This research is examining whether education alone, outside of income, has an effect on the odds of not receiving diabetes-specific preventive services with the added component to determine if these odds are further moderated by gender. The answers gleaned from the analyses will help to begin to unpack the relationship between gender, the social determinant education, and diabetes-specific preventive services.

### ***Out of pocket costs as a Barrier to Preventive Services***

Out of pocket costs as a barrier to preventive services for diabetes patients has received more extensive study in the scientific literature. The *Translating Research into Action for Diabetes* – or TRIAD – for example, examined 10 managed health plans across the United States serving ~180,000 patients. Researchers were able to examine a population of diabetes patients (respondents) (n=11,922) in order to assess how the cost of preventive services affected their usage. One of the characteristics studied was the cost structure, or rather, how much individual patients were expected to pay out of pocket for the treatment. Results showed that even free services were underutilized, but also that as cost went up, usage went down; suggesting that out of pocket costs is an important barrier to treatment, though not the only barrier (Karter et al., 2003). Lian et al. (2013) further demonstrates the relationship between cost and diabetes-specific preventive services usage. Researchers conducted a randomized control trial, in which a control group (n=1387) was charged standard rates for retinal screening and the treatment group (n=1379) was given the treatment free of charge. Results demonstrated that there was a

higher chance of uptake for the for free group (treatment group) than the lower income groups (standard rates charged?). The uptake, however, of the free group was comparable to the uptake among the control groups two highest SES groups, indicating a relationship between an ability to pay and the uptake of services (Lian et al., 2013).

Research examining out-of-pocket costs indicates that out-of-pocket costs might affect men's healthcare seeking more so than women. Sandman et al., for example, found that men with lower incomes were less likely to report having a regular doctor and that it is extremely difficult for them to visit one ("Out of Touch," 2000). More recent research demonstrates that men have been shown to visit the doctor less than women due to out-of-pocket costs. Kozhimannil et al., for example, found that among a population of 6007 men and 6530 women, men were less likely to visit the doctor after an employer-mandated switch to high-deductible health plans (under which employees had to pay more out of pocket) (Kozhimannil, Law, Blauer-Peterson, Zhang, & Wharam, 2013). This was true for all levels of severity regarding reasons for emergency department visits. Studies such as these indicate the need to pay closer attention to out of pocket cost issues when it comes to barriers to care.

Policy makers are beginning to acknowledge this issue as a primary focus of reducing the diabetes burden. The Affordable Care Act, signed into law in 2010, calls for reducing barriers to preventive services through cost reduction ((ASPA), 2015); however, it is still too early to determine the law's effect on cost reduction and utilization ("The Affordable Care Act and Diabetes Diagnosis and Care: Exploring the Potential Impacts - Springer," n.d.). This research will facilitate the understanding of the effect out-of-pocket costs has on the receipt of diabetes-specific preventive services and how sex might affect this relationship. Furthermore, the results will aid in the creation of appropriate interventions aimed at increasing usage of diabetes-specific preventive services and whether gender should be a primary focus.

***Lack of Insurance as a Barrier to preventive services and Diabetes Care***



Several studies have shown that the acquisition of insurance is related to accessing more preventive care (Sommers, Baicker, & Epstein, 2012), and better health outcomes as well (Institute of Medicine (US) Committee on the Consequences of Uninsurance, 2002). For example, one study using the National Health and Nutritional Examination Surveys (NHANES) – examined the relationship between having Medicaid (n=1485) and not having Medicaid (n=2975) and 3 chronic illnesses: obesity, diabetes, and hypercholesterolemia. Putative markers, such as “chronic disease indicators,” including taking drugs known to treat certain conditions and outpatient care services (visiting a doctor), in order to assess whether those with Medicaid were more likely to adhere to the regimen and/or visit their physician. Results for the outcomes portion were mixed in that there were no significant differences among insurance types (covered vs. non) and diabetes awareness or care, but there were significant differences for those with hypertension in that those with Medicaid had greater odds of successfully managing their condition. Those with Medicaid were also 8.4 times more likely to have visited a physician for their condition at least once than those without any insurance at all (Christopher et al., 2016). Results such as these reveal that those with insurance are more likely to visit a physician.

That insurance increases preventive services usage is evident within the provided research, but whether it improves outcomes remains controversial, according to some studies. Several studies conducted that examined the Oregon Health Insurance Experiment (OHIE), for example, have produced little evidence that better health inherently follows receiving health insurance. Baicker et al. (2013) conducted a randomized trial where individuals were randomized – via a lottery – into Medicaid (n=6387) while others (n=5842) were wait-listed in order to assess the effect of Medicaid expansion on actual health and found no significant differences in health between the two groups across a wide variety of illnesses and indicators. Differences in preventive services usage, however, did emerge. The results, for example, showed that Medicaid coverage predicted higher rates of healthcare usage, self-reported health, as well as reduced financial strain (Baicker et al., 2013). The Oregon research study, as well as

the others presented, point to a need to focus on how insurance coverage can affect an individual's ability to seek preventive services.

Although several studies illustrate the need for health insurance, little work has been done focusing on whether there are disparities on how insurance coverage affects the relationship between coverage, usage and sex. That is, most research focuses on which sex more often has coverage and not necessarily on whether the presence of coverage moderates the relationship between whether males or females seek more coverage. A study, however, conducted using the Oregon Medicaid expansion as a natural experiment examined whether the acquiring of coverage affected levels of certain types of cancer screening. The results revealed that of the approximately 16,000 participants, no differences were seen among males for male-specific types of screenings; whereas, among females, the presence of coverage significantly increased screening rates for 3 of 4 female-specific screenings (Wright et al., 2016). Research such as this, and cited above, point to a need to investigate how gender affects healthcare services usage between men and women.

The current study adds to the literature in that the questions asked are examined not only through a disease-specific lens, but also will separate individual effects for males and females from one another. The end result will be a closer look at whether all of these barriers to care are more concerning for men or women.

### **Limitations in current research**

Chronic illness research is often examined through a very broad lens versus a disease specific one. The socioecological model (SEM) helps focus that lens and understand connections between determinants and specific diseases. The majority of existing research encompasses a host of services with a focus on self-administered techniques, and what serves as barriers to them. These techniques and tools that individuals can use to control their condition may or may not be learned at a physician's office. The biopsychosocial model helps contextualize the intersectionality of how the services interact with sex. Consequently, what is lacking is research that demonstrates which barriers exist for physician-specific preventive services. The bulk of the barriers to healthcare services research that does focus on diabetes is centered on the presence/absence of insurance coverage and out-of-pocket costs. While both of these are important barriers – and hence, are included in this research – they do not explore these factors in conjunction with SES or sex. What is needed is research that examines the specific relationship between diabetes-centered physician's visits and the barriers that prevent individuals from receiving them. This research will begin to examine if these barriers vary by sex.

Another limitation is a lack of cohesiveness among the studies, which leaves unanswered questions as to which social determinants might serve as the largest obstacles to seeking/receiving preventive services for diabetes. That is, while – as the WHO CSDOH (2012) and Zgibor (2001) article point out – there are many barriers to services, the research does not reflect a socioecological approach to the problem. The majority of work done in this area is piecemeal, focusing instead on a variety of illnesses and services; combining individual practices learned at a physician's office in conjunction with those visits. To contribute to this literature, research should focus on social determinants as a whole and how they independently, and collectively, affect receipt of diabetes-specific preventive services.

The limitations mentioned above speak to a gap in the literature between disease and determinant. More needs to be done that examines links between specific illnesses with a specific type of preventive service. This is not to prioritize diabetes over other chronic illnesses, or physician's visits over self-administered preventive strategies, but rather to illustrate the importance of how particular barriers to care may influence the receipt of diabetes-specific preventive services; as well as what/which interventions might best serve subpopulations of patients and illnesses. Out-of-pocket costs, for example, might present more of a barrier for treatment for certain conditions than others; if a condition requires more visits, for instance. Consequently, research into specific barriers and illnesses is needed to begin understanding how they, along with their preventive strategies, compare to one another. This research will aid intervention developers in understanding whether diabetes-specific services are subject to the same patterns of disuse by males and whether specific barriers to care operate differently for males.

In addition to the shortage of diabetes-specific preventive services and social determinants research, more research is needed that considers gender and how it might affect the relationship between preventive services and barriers to care. As the research demonstrates, men and women think about their health differently, but also the way in which they seek to attend to it, as well as the differences in how the systems males and females exist in treat them. That is, while women seek *preventive services* more than men, men tend to seek the "*needed medical care*" they need more than women (AHRQ Women, 2014). Contradictions such as this indicate a need to explore potential reasons for these differences rather than just controlling for gender in the analysis. This research will examine not only if men are less likely to receive diabetes-specific preventive services than women, but also whether the odds of receiving the care – due to commonly explored barriers – are negatively affected by gender.

## **Contributions to the Literature**

The current study will contribute to the field in a variety of ways. The primary hypothesis is that men will be less likely to receive diabetes-specific preventive services. This will illuminate the need for a sex-focused approach to improving access to preventive services, which will in turn aid interventionists in developing more appropriate tools for reducing the diabetes burden.

Second will be an examination of barriers through a gender-based lens. Specifically, this study will highlight the effect sex has on individual barriers including education level, presence of insurance coverage, and out-of-pocket costs. That is, while we know that out-of-pocket costs can serve as a barrier to care – even some studies showing that it is a barrier for diabetes patients specifically – this study will examine whether these barriers are more pronounced for males versus females. Third, these questions will be explored utilizing a large dataset, which will provide a more generalizable picture of how these barriers impact diabetes prevention.

Finally, examining this issue through the lens of the biopsychosocial model will help better inform policy makers and intervention developers as to reasons why – or why not – males may vary in their response to efforts to increase physician's visits. The results will speak to whether it is due to interaction between gender and other commonly accepted external barriers.

## **Summary**

Diabetes is a chronic illness, which puts individuals, and their health at risk. Type 2 Diabetes is one of the most expensive, common, and preventable chronic illnesses (“Multiple Chronic Conditions Chartbook - mcccchartbook.pdf,” n.d.). It is estimated that the total cost of diabetes rose 41% (\$174B to \$245B) from 2007 to 2013 (Ria & 1-800-Diabetes, n.d.). Moreover, it is estimated that 8.1 million people remain undiagnosed in the United States (“National Diabetes Statistics Report, 2014 - national-diabetes-report-web.pdf,” n.d.). Striking numbers such as these reveal the need for research that aims to facilitate the reduction of this burden.

Existing research demonstrates the need for this particular study in that it elucidates the gaps in chronic illness research writ large. With such a pernicious disease, it is important for those aiming to reduce the burden of diabetes to understand the nature of the obstacles, which might prevent an individual from seeking/receiving the proper care needed to be properly diagnosed, receive adequate care, and/or receiving the necessary supervision required to keep her/his condition under control. This work aims to help reduce the burden by adding to the understanding of how known barriers to care are affected by sex. The overarching hypotheses reflect a – research-substantiated – supposition that males will have higher odds than females of not receiving preventive services for their diabetes, and that the negative effect of the obstacles to receiving this care will be exacerbated by being a male. This is not meant to be exhaustive, or exclude other barriers, but rather to help begin to parse out the obstacles so that interventions and policies might be better informed.

The US spends more on healthcare (17.5% of GDP) (“FastStats,” n.d.) than any other industrialized democracy and as these numbers have increased, and so has the need for policies and prevention methods informed by sound research. This work aims to fill this need as well as facilitate the reduction of the burden of diabetes.

## **Specific Hypotheses**

PRIMARY HYPOTHESIS H0: The odds of not receiving diabetes complications preventive services will be greater for those who report being males and also report having a diabetes diagnosis; the referent group is females who report a diabetes diagnosis.

### SECONDARY HYPOTHESES:

H01a: Having insurance during the past 12 months is associated with greater odds of receiving diabetes-specific physicians visit.

H01b: Males without insurance during the last 12 months will have higher odds of not receiving diabetes-specific physician's visits than females without insurance.

H02a: Not foregoing seeing a doctor during the past 12 months due to cost is associated with greater odds of receiving diabetes prevention services.

H02b: The odds of receiving diabetes prevention services among persons who did not forego seeing a doctor during the past 12 months due to cost is lower for males than females.

H03a: Higher education is associated with greater odds of receiving diabetes prevention services.

H03b: The odds of receiving diabetes prevention services among persons with higher education is lower for males than females.

## **Chapter 2: Methods**



## **Survey Instrument**

The research questions in this project will be addressed using the Behavioral Risk Factor Surveillance System (BRFSS) (“CDC - BRFSS,” n.d.). The BRFSS is a state-based survey administered annually by health departments via primarily landline and cellular telephones, as well as some in-home interviews. The BRFSS was established in 1984, originally including data from only 15 states. All 50 states, as well as the District of Columbia, now participate in the survey. It is a cross-sectional survey conducted by state health departments. The BRFSS is designed to collect prevalence data on non-institutionalized U.S. adult resident populations regarding risky behaviors and preventive health practices. Data is sent to the Centers for Disease Control and Prevention, where it is aggregated by state and returned with standard tabulations to be published at the end of the year by each state. More than 400,000 interviews are conducted annually by the 50 states and the District of Columbia (“CDC - 2014 BRFSS Survey Data and Documentation,” n.d.).

The BRFSS is administered in a variety of ways throughout the United States; which is dictated in some ways by the individual states. Each state has control over the administration mode (telephone, cell or land and/or personal interviews), which questions they include, with exception given to the fixed core, as well as how the data gleaned from the survey is later used. There are analytical methods to ensure that it remains a nationally representative data set. The primary issues that must be dealt with are:

- Differences between cellular and landline administered surveys
- Differences in the probability of individuals being selected for the BRFSS
- Differences in probability of household selection for the BRFSS as well as number of adults in the household
- Differences in the weights each state has independent of other states

The purveyors of the BRFSS calculated weights for each strata for each of these issues. For example, calculated the stratum weight – which involves the probability of an individual being selected – by using three calculated weights:

- ***Number of available records*** and number of records selected within a geographic region/strata and density strata
- ***Geographic strata*** which may be a state, geographic area, county, or census tract and/or subset of each
- ***Density strata*** indicating the density of phone numbers for a given block of numbers

These variables are calculated by the CDC authority who handles the BRFSS. Each analysis must correctly identify the correct weighting and stratification variables for each state. If this does not occur, individuals will be given incorrect weights, which will render the analysis invalid.

The above example is but one set of variables used to account for the probability of being selected for participation. Each one of the above mentioned weight issues requires a sequence of weighting variables to be used correctly – while programming the procedures – during the analysis. Correct programming will require special attention be paid to coding the variables during the data clean up so that the analysis can run smoothly. Listing all the variables, however, will require beginning the analysis in order to pick and choose from the relevant state’s survey types and specific strata weights. Consequently, a full addendum with these procedures will be offered with the results.

There are 3 components, or questionnaires, to the BRFSS, as described below. The questions may change on an annual basis.

1) The core component, which comprises the a) fixed core (queries related to demographic information as well as current health behaviors) which must be asked, b) rotating core (two distinct sets, which alternating states ask every other year. If a state decides that a rotating core set of queries is important,

they may include it in their optional module), and c) emerging core (questions serve a unique purpose in that they focus on emerging health issues that might be deemed important);

2) Optional Modules: Up to the discretion of the state as to which is included and when. The diabetes module, asthma module, as well as a host of others, are up to the state to include; and

3) State-added questions: Related to issues individual states deem important enough to include

The optional module and state-added questions are susceptible to change by year (“CDC - BRFSS - Questionnaires,” n.d.).

The (BRFSS has been used in studies across the risk factor-chronic disease spectrum. For example, it has been used in studies assessing the association between cigarette smoking and obstructive pulmonary disease (“Associations of Self-Reported Cigarette Smoking with Chronic Obstructive Pulmonary Disease and Co-Morbid Chronic Conditions in the United States.,” n.d.) adverse childhood experiences, risky behaviors, and morbidity and mortality (due to chronic illnesses), as well as diabetes-specific research (Sohn et al., 2016). One of its primary uses is to examine which risk factors are associated with certain chronic conditions so that policy makers can make informed choices with regard to who is at most risk as well as developing preventive measures for chronic conditions (Chowdhury et al., 2012). In a similar vein, the BRFSS will be used in this research to assess whether males are more likely to not receive diabetes-specific preventive services. Covariates will also be explored, including out-of-pocket costs, income level, and education/knowledge. We will determine whether these socioeconomic-related covariates moderate the effect of gender on receipt of diabetes-specific preventive services.

### **Subjects and Setting**

The Diabetes Module is part of the optional module of the BRFSS. The most recent year, 2014, of the BRFSS will be used (“CDC - 2014 BRFSS Survey Data and Documentation,” n.d.). There were 25 states - Alaska, Arizona, Connecticut, Delaware, District of Columbia, Florida, Georgia, Indiana,

Iowa, Louisiana, Maine, Mississippi, New Jersey, New Mexico, North Dakota, Ohio, South Carolina, South Dakota, Tennessee, Virginia, West Virginia, Wyoming, Guam, Puerto Rico, Nebraska, and Texas – that administered the Diabetes Module in 2014 (“CDC - BRFSS - 2014 BRFSS Modules Used by Category,” n.d.-a). That is, for those 25 states, all interviewees were asked the fixed core questions as well as the diabetes module questions.

Certain portions of the BRFSS are administered intermittently by individual states, while a large portion of the BRFSS is administered nationwide. The CDC uses methods to ensure that results are representative of each state the modules are conducted in. There are statistical procedures, such as post-stratification weighting, which enhance its nationally representative nature. Post-stratification helps account for portions of the population which may be under- or over-represented in the sample by adjusting for either non- or over-response bias. The CDC began using “raked” weighting methods “raking” more recently, which is not as susceptible to problems with small populations and allows for the inclusion of more demographic variables when weighting the data (“The BRFSS Data User Guide June 2013 - userguidejune2013.pdf,” n.d.).<sup>1</sup> Moreover, research outside the CDC has shown that the BRFSS produces results in national samples comparable to those of other large surveys, such as the National Health Insurance Survey (Nelson, Powell-Griner, Town, & Kovar, 2003).

The inclusion criteria for BRFSS for this project are as follows: any adult (>18 years of age) with a telephone, or living in a primary or secondary residence in the state that implements the survey in 2014. Those included in the analysis are respondents taking part in the BRFSS, which are those individuals who completed at least the demographic portion of the fixed core module (“CDC - 2014 BRFSS Survey Data and Documentation,” n.d.). The sample of BRFSS respondents, who are used for this research are those adults of working age (18-64) who answered “yes” to question 6.12, from the fixed core module, “(Ever told) you have diabetes?” Preliminary analysis revealed that 61,000 individuals answered “yes,” giving this study a sufficient sample size. The study sample, consequently,

will be those adults, 18 YOA or older, who completed the demographic component of the fixed core portion of the BRFSS and who have a self-report diagnosed diabetes.

State health departments use rigorous sampling measures to ensure that individuals participating in the interviews are representative of the populations in the state. Phone numbers, for example, are attained using Random Digit Dialing, which is able to capture numbers that are not listed, as well as stratify by county so that the homes reached are a random sample of the total population (Street, NW, Washington, & Inquiries, 2015b). Health departments take similar measures to ensure the homes they visit are randomly selected (“The BRFSS Data User Guide June 2013 - userguidejune2013.pdf,” n.d.). According to the same guide, while each state might use additional methods to ensure randomness, all protocols related to the BRFSS must be followed in order to ensure the fidelity of the survey. Consent is especially important in the collection of data. The process, however, is very complicated due to the fact that it is different in each state. Given the varying modules conducted by each state, there are different procedures, which vary by year. Some states ask the consent questions before the Asthma survey, while some ask directly after the initial BRFSS, as one example (“CDC - BRFSS - BRFSS Frequently Asked Questions (FAQs),” n.d.).

This study comprises secondary data obtained using data that are in the public domain, thus, Institutional Review Board (IRB) clearance is not needed for this study (“CDC - BRFSS - BRFSS Frequently Asked Questions (FAQs),” n.d.). In addition, the Georgia State University IRB has determined that approval is not needed for certain publicly available datasets. The BRFSS is one of these (“Policy for Publicly Available, Archival, and Secondary Data,” n.d.).

### **Statistical Analysis**

The primary outcome to be studied – dependent variable – is whether the survey respondent reported visiting the physician for their diabetes. The outcome is self-assessed using the BRFSS diabetes module mentioned above. Respondents responded to the BRFSS question: *About how many times in the*

*past 12 months have you seen a doctor, nurse, or other health professional for your diabetes?* In addition, secondary outcomes will include potential barriers preventing individuals from visiting a physician for his/her diabetes. These barriers are also self-assessed using the BRFSS, with each one belonging to a separate module throughout the survey. That is, individuals responded to questions throughout the survey assessing whether, which will serve as predictor variables or covariates of interest: (1) *Was there a time in the past 12 months when you needed to see a doctor but could not because of cost*, (2) *In the past 12 months was there any time when you did NOT have ANY health insurance or coverage*, and (3) *What is the highest grade or year of school completed?* Responses to these questions will be coded as (1) Lack of Health Insurance, (2) Medical Costs, and (3) Education.

Descriptive statistics as well as Wald Chi-square analyses will be ran in order to determine whether statistically significant disparities exist between males and females related to physician's visits for diabetes secondary prevention. The assumptions for ordinal logistic regression – dependent variable is ordinal, independent variables must be ordinal, categorical, or continuous, there is no multicollinearity, and the odds of the DV are proportional - will be assessed and tested in order to ascertain the quality of analysis and whether ordinal regression can be used. If all of the assumptions are not satisfied, logistic regression analyses will then be conducted in order to glean whether the accepted barriers to care are statistically significant barriers for diabetes-specific care. Moderator (interaction terms) will, finally, be entered into the model to determine if the odds of not receiving care vary significantly for males and females and whether the barriers to care are more likely to be barriers for males than females. All of these analyses will be conducted using SAS 9.3.

### **Chapter 3: Analysis & Results**

## **Analytic Methods**

Descriptive statistics, Wald-chi, and logistic regression analyses were conducted. The assumptions for ordinal logistic regression were all assessed and tested. The proportional odds assumption for ordinal logistic regression was not satisfied; consequently logistic regression was conducted as the primary analysis to assess disparities between males and females. The Dependent variable – level of diabetes-specific care –was discretized into two levels: sub-optimum care (3 or less than visits per year) and optimum care (4 or more visits per year). Most of the independent variables were treated as they are designed in the BRFSS. The exception is education, which was categorized into categories of no high school, high school diploma or GED (?), beyond high school, and college diploma and beyond. Females were determined the referent in all analyses. Optimum level of care was considered the referent in all analyses. All analyses were conducted using SAS 9.3 Enterprise.

## ***Results***

### ***Preliminary Analysis***

A preliminary analysis was conducted in order to determine whether statistically significant disparities existed between males and females regarding diabetes-specific care. Descriptive statistics demonstrated differences in key areas. There were 26 states that administered the Diabetes Module in 2014. BRFSS documentation shows that in 2014, approximately 61,000 respondents reported previously receiving a diabetes diagnosis. The sample population for this research is of adults aged 18-64 who reported having a diagnosis of diabetes and were administered the diabetes module included 12,821 of those 61,000 (missing=142).

Of these respondents, 43% were males and 57% were females. Sixty-two percent of the respondents were white, non-Hispanic while 16% were black, non-Hispanic, and 13% were Hispanic. The United States census data reports that of those reporting 2 or more races, 62% reported being white,



13% African-American, and 18% Hispanic (“Population estimates, July 1, 2015, (V2015),” 2015). The remainder of the respondents were categorized as other or Hispanic. The mean age was 55. Military status was examined due to respondents reporting they had been active military were likely to be enrolled in Tri-Care, which could have potentially affected the relationship between the DV and the predictor variables of presence of insurance. Preliminary analyses, however, revealed that the percentage (11%) of those reporting active status was small enough to not pose a problem.

**Table 1: Demographics of selected participants in the Behavioral Risk Factor Surveillance System for year 2014\***

<b>Respondent Characteristic</b>	<b>(n=)</b>	<b>Frequency</b>	<b>Weighted Frequency</b>
<b><i>Gender</i></b>	12,821		
Male		5,555 (43%)	3,473,016 (50%)
Female		7,266 (57%)	3,448,777 (50%)
<b><i>Race</i></b>	12,587		
White, NH		7,827 (62%)	3,584,016 (52.6%)
Black, NH		2,070 (16%)	1,479,369 (21.7%)
Other, NH* <sup>1</sup>		1,041 (8%)	354,318 (5.2%)
Hispanic		1,649 (13%)	1,402,964 (20.6%)
<b><i>Age</i></b> <sup>*</sup>			
18-64		54.3 (.08)	51.95 (.23)
<b><i>Education</i></b>	12,714		
Below High School		1,637 (13%)	1,452,700 (21%)
High School		4,130 (32%)	2,153,801 (31%)
Attended college or Technical School (no degree)		3,785 (30%)	2,116,755 (31%)
College Degree or Tech School		3,162 (25%)	1,147,442 (17%)
<b><i>Income</i></b>	11,197		
Less than 10,000		1,292 (12%)	759,686 (12.6%)

**Table 1: Demographics of selected participants in the Behavioral Risk Factor Surveillance System for year 2014\***

10,000 to 14,999		1,175 (10%)	610,264 (10.1%)
15,000 to 19,999		1,215 (11%)	714,342 (11.8%)
20,000 to 24,999		1,198 (11%)	672,084 (11.1%)
25,000 to 34,999		1,146 (10%)	635,468 (10.5%)
35,000 to 49,999		1,451 (13%)	685,078 (11.4%)
50,000 to 74,999		1,506 (13%)	771,133 (12.8%)
75,000 or more		2,214 (20%)	1,189,093 (19.7%)
<b>Military Status</b>	12,790		
No		11,323 (89%)	6,109,893 (88.4%)
Yes		1,467 (11%)	803,870 (11.6%)
<b>Medcost</b>	12,773		
Did not		2,591 (20%)	1,640,537 (23.8%)
Had no effect		10,182 (80%)	5,262,001 (76.2%)
<b>Lack of Health Insurance</b>	12,773		
Did not		1,354 (11%)	1,034,351 (15%)
Did		11,419 (89%)	5,866,335 (85%)

\* All values are frequencies and percentages, except for age, where mean and standard error are shown; due to large population

Results from analysis 1 revealed differences between males who reported visiting their physician the optimum number of times ( $\geq 4$ ) compared to females who did. That is, a smaller proportion of males reported visiting their physician for diabetes (40.14%) than females (45.61%). Males, however, were more likely to report visiting their physician for diabetes at all (minimum recommended number of times (1-3)) when compared to females (48.41%, 44.18%). Table 2 shows these results.

**Table 2: Unweighted Distribution (percentage and frequency) of selected Behavioral Risk Factor Surveillance System participants, stratified by gender and level of health care (2014) for Analysis**

SEX	Level of Care	Frequency	% of Gender
Male	NoCare	627	11.45%
	SubCare	2651	48.41%
	OptCare	2198	40.14%
	Total	5476	100.00%
Female	NoCare	736	10.22%
	SubCare	3182	44.18%
	OptCare	3285	45.61%
	Total	7203	100.00%
Total	NoCare	1363	10.75%
	SubCare	5833	46.01%
	OptCare	5483	43.24%
	Total	12679	100.00%

Wald Chi-square results for analysis 2 demonstrated a difference in the weighted percentages of males who visited the physician for their diabetes as compared to females (Table 3). Males, for example, were less likely to visit the physician (39.35%) than females (44.48%) the recommended number of times. Conversely, a larger proportion of males (46.14%) reported visiting their physician for their diabetes than females (42.42%) the lesser recommended number of times (1-3). These results were significant ( $p < .0189$ ).

**Table 3: Wald Chi-square Results for Analysis 1.**

SEX	Level of Care	Frequency	Weighted	Std Dev of	Percent	Std Err of
Male	NoCare	627	494615	45923	14.51%	0.6499
	SubCare	2651	1572494	62583	46.14%	0.8484
	OptCare	2198	1341293	63654	39.35%	0.8514
	Total	5476	3408402	93840	100.00%	0.9962
Female	NoCare	736	428981	32939	12.69%	0.4778
	SubCare	3182	1433704	52330	42.42%	0.7515
	OptCare	3285	1516823	54000	44.48%	0.7677
	Total	7203	3379507	74847	100.00%	0.9962
Total	NoCare	1363	923596	55703	13.60%	0.7694
	SubCare	5833	3006198	76657	44.28%	0.9819
	OptCare	5483	2858115	79584	42.10%	0.9814
	Total	12679	6787909	102467	100.00%	

Results from analysis 2 yielded similar differences in males who reported visiting the physician for diabetes the recommended number of times. Males, for example, were less likely to receive the optimum number of physician's visits ( $\geq 4$ ) for their diabetes when Care2Cat is dichotomized into Subcare and Optcare (40.14%, 45.61%). Males were also less likely to visit the physician for their diabetes at all, and the lower number of recommended number of times ( $\leq 3$ ) when compared to females. Table 4 shows these results.

**Table 4: Unweighted Distribution of Population for Analysis 2**

SEX	Care2CAT	Frequency	% of Gender
Male	SubCare	3278	59.86%
	OptCare	2198	40.14%
	Total	5476	100.00%
Female	SubCare	3918	54.39%
	OptCare	3285	45.61%
	Total	7203	100.00%
Total	SubCare	7196	56.76%
	OptCare	5483	43.24%
	Total	12679	100.00%

Results from the Pearson's Chi-square for analysis 2 revealed that the patterns remain and are statistically significant even when weighted. Males are less likely to visit their physician the optimal recommended number of times when compared to females (39.35%, 44.88%). This pattern holds in that males are more likely to receive less than the recommended number of visits when compared to females (60.65%, 55.12%). These results are statistically significant  $\chi^2(1, n=12,679) = 39.77$   $p=.0051$ . Table 5 shows these results.

**Table 5: Wald-Chi Results for Analysis 2**

SEX	Care2CAT	Frequency	Weighted Frequency	Percent
Male	SubCare	3278	2067109	60.65%
	OptCare	2198	1341293	39.35%
	Total	5476	3408402	100.00%
Female	SubCare	3918	1862685	55.12%
	OptCare	3285	1516823	44.88%
	Total	7203	3379507	100.00%
Total	SubCare	7196	3929794	57.89%
	OptCare	5483	2858115	42.10%
	Total	12679	6787909	100.00%

In addition to chi-square tests, logistic regression tests were conducted. The previous tests demonstrated that a dichotomized dependent variable was sufficiently sensitive to detect a variance between males and females. Consequently, in order to examine whether males would be at higher odds of not seeking diabetes-specific care, logistic regression tests were run. Results of the logistic regression revealed that males were at higher odds of not seeking care for their diabetes OR=1.25, 95% CI (1.09-1.51),  $p=.002$ .

### **Results (Final analyses; Logistic Regression)**

The crude odds revealed that the chosen variables of interest, in some cases, increased the odds of not receiving optimum care for both males and females. Respondents who cited not seeking diabetes-specific care due to medical costs, for example, were more likely to have not received the recommended minimum number (4) visits for their diabetes (OR=1.49, 95% CI (1.19, 1.87)). The lack of health insurance, similarly, increased the odds of both males and females not receiving the recommended level of care (OR=1.65, 95% CI (1.19, 1.87)). Respondents with low education were more likely to receive optimum care when compared to those with college education (OR=.64, 95% CI (.461, .882)). Those

with education beyond high school also had significantly higher odds of receiving optimum care (OR=.73, 95% CI (.549, .972)). These results are found in Table 6.

**Table 6: Odds of Not Receiving Optimum Level of Care\* based on Independent Variable of Interest**

<b>Risk Factor</b>	<b>Observations used</b>	<b>Crude Odds</b>	<b>(95% CI)</b>
Medical Costs <sup>a</sup>	12,631	1.49	(1.19, 1.87)***
Lack of Health Insurance <sup>b</sup>	12,632	1.65	(1.12, 2.41)***
Education <sup>c</sup>	12,573		
No High School		.64	(.461, .882)***
High School		.73	(.549, .972)***
Beyond High School		.95	(.722, 1.25)

\* Optimum care is meeting minimum number of visits (4)

\*\*\* Significant at  $p < .05$

<sup>a</sup> Medical Cost is not an issue is referent group

<sup>b</sup> Presence of Health Insurance plan is referent group

<sup>c</sup> College education is referent group

The crude odds of males not receiving the optimum level of diabetes-specific are significantly higher than for females in some cases. That is, while controlling for the effect of the three covariates of interest, males had nearly 1.3 (95% CI 1.09, 1.51) times the odds of not receiving optimal diabetes care as compared to women. Respondents who reported not having health insurance had over twice the odds of not receiving optimal diabetes care (OR= 2.18, CI 95% (1.59, 2.99)). Analyses showed that lower education (no high school) as well as having a high school diploma, were both significantly associated with greater odds of receiving optimum care when compared to those with a college education. These findings are significant for both no high school and high school, but not for those with high school experience and beyond. Those who cite medical costs as a reason for not visiting the physician are 17% more likely not to have visited a physician for their diabetes (OR=1.17, 95% CI (.94, 1.44)), although this is not significant. Those without health insurance, however, were more likely to not have visited a

physician for their diabetes, which was significant (OR=2.18, 95% CI (1.59, 2.99)). Conversely, the effect of medical costs on receiving diabetes care was insignificant. These results are in Table 7.

**Table 7: Odds for Not Receiving Optimum Level of Care<sup>\*</sup> based on Models with Sex and covariates of interest, while controlling for age, race, vet status, and income**

<b>Risk Factor</b>	<b>Observations used</b>	<b>Adjusted Odds</b>	<b>(95% CI)</b>
Sex <sup>a</sup>		1.28	(1.09, 1.51) <sup>***</sup>
Medical costs <sup>b</sup>		1.17	(.94, 1.44)
Lack of Health insurance <sup>c</sup>		2.18	(1.59, 2.99) <sup>***</sup>
Education <sup>d</sup>	12,573		
• No High School		.553	(.43, .711) <sup>***</sup>
• High School		.706	(.549, .972) <sup>***</sup>
• Beyond High School		.965	(.778, 1.20)

\*Optimum care is meeting minimum number of visits (4)

\*\*\* Significant at  $p < .05$

<sup>a</sup> Female is the referent group

<sup>b</sup> Medical Cost is not an issue is referent group

<sup>c</sup> Presence of Health Insurance plan is referent group

<sup>d</sup> College education is referent group

### Adjusted odds

The adjusted odds are significant in some cases. Those males who cite not visiting a physician due to the costs of going, for example, were less likely to receive diabetes-specific care than women. Results showed that males were less likely to receive diabetes-specific care than females. This pattern holds when considering medical costs for males, while controlling for age, race, vet status, and income. That is, males who reported not visiting a physician for care due to medical costs were 51% more likely not to visit the physician for their diabetes OR=1.51, 95% CI (1.23, 1.87)) than females. The odds that males would not receive care for their diabetes was significantly higher for those who lacked of health insurance compared to those who reported having insurance OR=2.34, 95% CI 91.72, 3.190). Education, however, did not emerge as a significant predictor for males or females, even when controlling for other

demographic variables. Sex remained a significant predictor in all variations of the model. Table 8 demonstrates these results.

**Table 8: Odds for not receiving optimum level of care<sup>\*</sup> by covariate of interest when controlling for age, race, vet status, and income**

<b>Risk Factor</b>	<b>Observations used</b>	<b>Adjusted Odds</b>	<b>(95% CI)</b>
Sex <sup>a</sup>	10,885	1.21	(1.01, 1.44) <sup>***</sup>
Medical costs <sup>b</sup>		1.51	(1.23, 1.87) <sup>***</sup>
Sex	10,703	1.17	(.98, 1.4)
Lack of Health insurance <sup>c</sup>		2.34	(1.72, 3.19) <sup>***</sup>
Sex	10,903	1.22	(1.02, 1.45) <sup>***</sup>
Education <sup>d</sup>			
• No High School		.98	(.73, 1.32)
• High School		1.01	(.79, 1.30)
• Beyond High School		1.18	(.94, 1.48)

\*Optimum care is meeting minimum number of visits (4)

\*\*\* Significant at  $p < .05$

<sup>a</sup> Female is the referent group

<sup>b</sup> Medical Cost is not an issue is referent group

<sup>c</sup> Presence of Health Insurance plan is referent group

<sup>d</sup> College education is referent group

Several of the predictor variables remained significant while controlling for age, race, vet status, and income. Sex remained significant with medical costs and the interaction term (sex and medical cost) ( $p = .0023$ ). The presence of health insurance remained significant with sex and the interaction term in the model. All interaction terms, however, were insignificant. The parameter estimates are presented as well as the p-values. Table 9 presents these results.



**Table 9: Parameter Estimate for not receiving optimum level of care\* by covariate of interest when controlling for age, race, vet status, income, and including interaction terms**

<b>Risk Factor</b>	<b>Observations used</b>	<b>Parameter Estimate</b>	<b>(p-value)</b>
Sex <sup>a</sup>	10,885	0.192	>.0023 ***
Medical costs <sup>b</sup>		.419	>.0007 ***
Sex&Medical costs	"	-.010	>.9599
Sex	"	.882	>.3061
Lack of Health insurance <sup>c</sup>		.6552	>.0022 ***
Sex*LackfInsurance		.4208	>.1578
Sex	10,903	.0692	>.6895
Education <sup>d</sup>			
• No High School		-.4861	>.0040 ***
• High School		-.3210	>.0284 ***
• Beyond High School		-.0764	>.5889
• Sex*NoHighSchool			
• Sex*HighSchool		.1879	>.4509
• Sex*GTHS		.1593	>.4955
		.2394	>.2684

\*Optimum care is meeting minimum number of visits (4)

\*\*\* Significant at  $p < .05$

<sup>a</sup> Female is the referent group

<sup>b</sup> Medical Cost is not an issue is referent group

<sup>c</sup> Presence of Health Insurance plan is referent group

<sup>d</sup> College education is referent group

Removing the interaction terms while also stratifying the models by sex and controlling for age, veteran's status, race, and income, yielded some meaningful results (Table 10). Predictor variables, such as medical costs and education, became statistically insignificant when all variables were included in the same model. The lack of insurance coverage, however, was significant for both males and females when all variables were introduced into the model (those lacking health insurance were more likely to not receive optimum care). Most notably, the odds of not receiving optimum level of diabetes-specific care among those lacking health insurance was almost twice as high among males compared to females

(OR=3.03, 95% (CI=1.92, 4.79)) versus (OR=1.64, (95% CI=1.06, 2.55)). These results are shown in Table 10.

**Table 10: Odds of males and females not receiving optimum level of care\* by covariate of interest when controlling for age, race, vet status, income, all in one model, and when stratified by sex**

Sex/Gender	Males (n=4,757)		Females (n=6,087)	
Risk Factor	OR	95% CI	OR	95% CI
Lack of Health Insurance <sup>a</sup>				
Yes	3.03***	(1.92, 4.79)	1.64***	(1.06, 2.55)
No	1.00		1.00	
Medical costs <sup>b</sup>				
Yes	1.28	(.900, 1.83)	1.28	(.977, 1.68)
No	1.00			
Education <sup>c</sup>				
Not graduate HS	1.00		1.00	
High School	1.15	(.784, 1.69)	1.10	(.769, 1.57)
Some college	1.28	(.900, 1.83)	1.28	(.977, 1.68)
College	1.01	(.645, 1.60)	1.35	(.916, 1.99)

\*Optimum care is meeting minimum number of visits (4)

\*\*\* Significant at p<.05

<sup>a</sup> Presence of Health Insurance plan is referent group

<sup>b</sup> Medical Cost is not an issue is referent group

<sup>c</sup> College education is referent group

## **Chapter 4**

## Discussion

Diabetes is one of the most expensive and common chronic illnesses in the United States (Gallup, n.d.) (Ward, Schiller, & Goodman, 2014) (“National Diabetes Statistics Report, 2014 - 2014-report-estimates-of-diabetes-and-its-burden-in-the-united-states.pdf,” n.d.). One of the most promising ways to ensure that those with a diabetes diagnosis can manage their illness and prevent further complications is by improving access to a physician. Research has shown that physician’s visits improve health outcomes and guidelines suggest them as one of the most necessary components of remaining healthy once diagnosed with diabetes (Utah Diabetes & Endocrinology Center, 2017). Despite the necessity of physician’s visits, healthcare services usage remains low. There are myriad reasons why individuals do not visit the physician; one of which is a medical healthcare infrastructure that reacts to illness rather than focusing on prevention (“Health Care in the United States | NESRI | National Economic & Social Rights Initiative,” 2017). Obstacles to care remain, however, even for those wishing to approach their illnesses with caution and foresight. Sex of the individual, for example, has been shown to be a risk factor in the inadequate receipt of healthcare services (A. 12 & Artiga, 2016). Additionally, the cost of care, lack of health insurance, and education, have all been shown to operate as barriers to healthcare utilization.

The purpose of this research was to first examine whether the pattern of females using diabetes-specific care was consistent with previous research writ large, among a population of those diagnosed with diabetes among the ~50% of states responding to the diabetes module of the BRFSS collected in 2014. This study examined, specifically, whether women received more diabetes-specific care than men. In addition, several barriers to optimum care, supported in previous research, were explored to determine how they impacted the receipt of diabetes care, and whether barriers were different among men and women. Hypotheses were partially supported throughout the study.

**The impact of sex and common barriers on diabetes physician visits (theoretical approaches)**

There were several theories and frameworks informing the study as well as guiding the hypotheses. The Social Determinants Framework[s] (CSDOH & Zgibor model), for example, elucidated the potential risk factors and barriers to care (CSDOH, 2011) (Zgibor, 2003). Both of these models were referenced in order to assess which barriers are most commonly associated with healthcare and, more specifically, care for diabetes. The CSDOH model proposes a broader spectrum of all social determinants, which might influence the well-being of an individual. These determinants comprise everything from gender to broader – systems level – determinants such as community factors and healthcare systems. The Zgibor model, conversely, offered a more diabetes-centric lens through which to examine potential barriers. Zgibor et al. listed several barriers that serve as impediments to proper diabetes care. Three of those – cost of care, education, and lack of health insurance – were chosen as the obstacles to care in this research. Both models aided in the formulation of the research questions in this study.

The literature review revealed a large body of research, which supports the claim that females typically receive more preventive services than males. The Biopsychosocial model addresses reasons why disparities in level of care between men and women might exist. There are several models and theories that examine health-related disparities between men and women, but the biopsychosocial model takes into account more than those characteristics that are particular to gender (Courtenay, 2013). Research has demonstrated that, along with the putative barriers to health decisions – such as cultural norms, homogenous masculinity, etc. – structural barriers to care, and the interactions between them and gender, might also negatively affect the health decisions of males more than females (Courtenay, 2000). The biopsychosocial model takes into account a wider array of determinants and so served as justification for the research questions in this study.

Both of these theories/models informed the primary and secondary hypotheses found in this work. As hypothesized, males were more likely not to receive the optimum level of care for their diabetes as compared to females. This is consistent with previous research related to preventive services writ large (A. 12 & Artiga, 2016) (Vaidya et al., 2012c). These findings demonstrate a need for considering sex – and its interaction with barriers – as a risk factor for the lack of optimum diabetes care as well as further research into reasons why these disparities exist.

Both cost of care and lack of health insurance have been shown in prior research to serve as barriers to care as well as to vary by sex; indicating that each potentially decreases the likelihood that males will receive preventive services (Kozhimannil, Law, Blauer-Peterson, Zhang, & Wharam, 2013) (Wright et al., 2016). Regarding the additional barriers explored, analyses demonstrated that some of the commonly accepted barriers to proper care do play an important role in the receipt of diabetes-specific care for males and females. Two of the explored barriers – medical costs and lack of health insurance – decreased the likelihood of men and women receiving the optimum level of care; validating the social determinants theories. Education, however, had the opposite effect of what was hypothesized in that lower education levels decreased the likelihood that males would not receive the optimum level of care; or, low education indicated that males would receive better care as compared to females. The effect of these barriers also proved to vary, even if not statistically, by gender. Males, that is, were less likely to receive the optimum level of care when reporting they had not had health insurance at some point during the past year. The Biopsychosocial model, consequently, was validated in so far as demonstrating the potential for a relationship between the characteristics of males and their health decisions as well as the external barriers encountered when attempting to seek care.

The findings in the current study, while not necessarily substantiating the biopsychosocial model, do offer an innovative approach to thinking about diabetes care. The broader social determinant lens, for example, elucidates which barriers might serve as impediments for patients with diabetes from visiting a

physician. Cost of healthcare and lack of a health insurance plan both remained significant contributors as obstacles to receiving care. The analyses did reveal that the effect of those covariates does vary by gender to an extent. Thus, these are barriers important for all diabetes patients, both males and females. While there are greater disparities in men getting the services they need for diabetes care, both of these factors increase the risk among diabetes patients in general not seeking the help they need.

There are several possible reasons why there were no significant differences among men and women related to these barriers. Cost of care might not have been as much of a contributor among the current population of study. The majority (56%) of this population reported having incomes of greater than \$25,000/year, with 20% reporting \$75,000 or more. Studies have shown that income matters more at the lower levels when considering health and health decisions (Marmot, 2002). The mean age, additionally, was approximately 55 years (un-weighted) and approximately 52 years (weighted); over half of the participants in this study reporting a diabetes diagnosis are approaching retirement age. Women are reported as having significantly less retirement savings than men (“National Institute on Retirement - Women 80% More Likely to be Impoverished in Retirement,” n.d.). This fact might serve as a barrier for women, hence counteracting the patterns seen in previous research.

The current study found that the presence of health insurance is associated with the optimum number of physician visits; however, sex did not statistically moderate this relationship. One possible explanation is the effects of the Affordable Care Act (ACA). Women have historically been insured at higher rates than men in the United States, which might account for previous research that documents males not receiving care as a result of no coverage (Day, Ohara, & Taylor, 2015). Insurance, however, has become more readily available – in participating states – for individuals of both sexes, such that the disparities between those with and without could have been mitigated in the four years between the ACA’s enactment and this survey. Research demonstrates that the ACA decreased disparities in insurance coverage among vulnerable populations since its enactment in 2010, but little has been done to

assess the ACA and gender in this regard (A. 12 & Artiga, 2016). Research, however, does indicate a decreasing gap in coverage between men and women in some cases (Day et al., 2015). The combination of increased access, along with the implementation of Insurance Exchanges, might have helped reduce the gap in coverage between males and females, hence decreasing the possibility of lack of a plan becoming a barrier for males.

### **Public Health Practice**

The hypotheses supported by this research contribute to public health practice at several levels across the social determinant spectrum. First, as stated above, is the importance of policy changes, which can continue to decrease gaps in insurance coverage between males and females. The ACA includes many provisions – increasing access to Medicaid by raising the minimum Federal Poverty Level (?) requirement, insurance exchanges – which increases access, which can potentially reduce gaps in coverage among vulnerable populations as well as between males and females. There are states that have not expanded Medicaid (provisions of the ACA) (“Status of State Action on the Medicaid Expansion Decision,” n.d.). The current administration, and Congress, moreover, are both taking steps to repeal the ACA (“Nancy Pelosi: GOP’s rush to repeal Obamacare is ‘act of cowardice’ - Washington Times,” n.d.), which if accomplished, could reverse some of the potential gains in coverage disparity reduction achieved by the law. Research such as this demonstrates the need for removing as many obstacles for males as possible in order to ensure these gains are not lost.

Second is a focus on how intervention efforts might reduce the gender disparities found in diabetes care. The results in this work show that males do not visit the physician the optimum number of times as often as females. This indicates a need for strategies targeting men for proper diabetes treatment. Research has shown that not all interventions fit all populations and that tailoring them can potentially lead to increased success rates (Bos-Touwen et al., 2015). Some possibilities include utilizing *Behavioral Insights* theories to tailor interventions to males. Behavioral insights are currently used by



governments and policy makers to design interventions, which will encourage individuals to make better health decisions (Organisation for Economic Co-operation and Development, 2016). Research has shown that by creating “identities” among specific groups of people, interventionists can initiate positive behavior change (Dawes & Messick, 2000). Dawes and Messick describe a culture of litterers in Australia, for example, which sees itself as anti-establishment whose statement is exemplified by actively littering. By creating an *identity* associated with more positive behaviors toward the establishment, research showed that littering could be reduced (Kolodko, Read, & Taj, 2016).

Research and Identity building could be employed to combat the inherent stigma, which males face when it comes to making health decisions. Research has shown that by merely changing the message received by the individual, interventions can produce higher success rates (Hawkins, Kreuter, Resnicow, Fishbein, & Dijkstra, 2008). Program developers could use these theories in order to create an outreach message more enticing to males. Male-centric messages might be used to encourage men to visit their doctor for their diabetes, rather than having a one-size-fits-all invite. Messages, for example, could focus on the duty a man has to his family to ensure he is in good health so that he can be a successful “Provider.” Other messages might include how the complications from diabetes can potentially negatively affect athletic performance. The primary objective would be to develop a sense of *identity* centered on the duties and goals of males. Males would hopefully, consequently, focus on the idea of being a good provider and/or someone concerned about their athletic ability versus a man who “needs” help.

The implications from these findings are not limited to diabetes care. Males who feel that seeking healthcare diminishes their masculinity, or by avoiding risk, are at an increased risk of negative health outcomes (Sloan, Conner, & Gough, 2015a). These beliefs and perceptions are at work across all health decisions. The findings, consequently, have the potential to inform public health practice and efforts across the chronic illness spectrum. Prostate cancer screenings, for example, might benefit from

the type of interventions developed predicated on Behavioral Insights theories. By more clearly understanding gender and its role in health decisions, interventions can have a positive impact on both males' and females' health (Sloan et al., 2015a).

These findings provide a couple of innovative ways to view the problem of complications from diabetes in a very general sense. One of the obstacles public health ethicists face, for instance, is the development of a substantive public health ethical framework; or, an ethic that is wholly separate and independent from the biomedical ethic, which serves as its progenitor (Dawson, 2011). Dawson points out that there are several concepts that need to be clearly defined within a public health context as well as decisions, which reflect the ultimate goal of public health, which need to be made. One of these decisions is *whose* health public health is attempting to address and to *what degree* should efforts be expected to have an effect. Should, for example, interventions aimed at reducing complications from diabetes attempt to elevate the health of those at highest risk to those patients who respond exemplarily to treatment? These findings suggest that males are at higher risk of not receiving the care they need to successfully manage their condition and that the lack of health insurance makes it even less likely. This study has the potential to begin answering the above question in that perhaps, ethically, interventionists should aim to reduce disparities related to physician's visits among diabetic populations; decreasing the gap of those with diabetes who seek the proper level of care between males and females. This also could reduce the diabetes burden. Research such as this informs the ethics of public health practice and begins to answer some important questions.

The results also demonstrated that the cost of healthcare remains a barrier to proper diabetes care regardless of gender. Much like health insurance, the cost of healthcare in the United States remains a significant concern for those needing/seeking care (Gallup, 2016) (Mendes, 2012). Programs intending to increase physician's visits might use this information to educate potential patients on the importance of seeing their doctor. Educational efforts, for example, could include cost comparisons between patients

who seek preventive care and those that do not. Individuals with diabetes might not be aware of the cost of not controlling their condition and seeing these plainly laid out might encourage them to make their care more of a priority. Reducing the cost of care is an obvious – and most desirable – route to circumvent this barrier and the Affordable Care Act has made inroads in this regard. Barring legislative action, developers could also use outreach methods to inform diabetes patients of ways by which they can better control their condition. Outreach efforts, for instance, could focus on the availability of care at local free clinics (Drive, 2016). Educational campaigns, in addition, could be aimed at strategies, such as foot checks and monitoring one's blood pressure, which can be taken care of in the home of the individual. A physician's visit for preventive maintenance is the most highly recommended, but these strategies have the potential to mitigate secondary complications when a preventive visit is not possible (Mayo Clinic Staff, 2017).

Finally, there are many efforts – programmatic, state wide, and nation-wide – aimed at reducing the burden of diabetes. This study begins the cumbersome task of parsing out the complexity of the barriers those with diabetes face in the successful attainment of care. It is hoped that by beginning to eliminate barriers that do – and do not – vary by gender, policy makers can make more effective decisions when it comes to program development and legislation.

### **Strengths of Research**

The cross-sectional nature of this study allowed for a comprehensive examination of large portions of the population in the United States. The BRFSS is nationally representative as a complete survey, but there are certain modules that are only offered alternately between years. The diabetes portion included participants from 26 states in 2014 (“CDC - BRFSS - 2014 BRFSS Modules Used by Category,” n.d.-b). This still serves as a large snapshot of populations living with diabetes, however can only be considered to result in state representation. The CDC, more importantly, has identified a group of southeastern states identified as the “Diabetes belt” (“CDC Identifies Diabetes Belt -

diabetesbelt.pdf,” n.d.) (Barker, Kirtland, Gregg, Geiss, & Thompson, 2011). The 2014 module included three of these states: Georgia, Florida, and South Carolina. Representation such as this allows for regional generalizability when it comes to the results as well as their implications. The diabetes belt is represented in these findings – to an extent – and patients suffering from diabetes in this region might benefit specifically from this research.

The BRFSS also has many merits, which add to the validity and robustness of these findings. Part of the dilemma surrounding telephone surveys is the growing number of individuals who use their cellular telephones as a primary phone. Research shows that nearly half of Americans no longer have a landline and instead use a cellular phone as a primary point of contact (Street, NW, Washington, & Inquiries, 2015a). This poses a problem when it comes to the potential “reach” of a survey in that cell phone numbers are not as readily accessible as landlines, and each mode has a different probability that the individual will answer, which can affect the representativeness of the data. The CDC began accounting for these differences in 2011 by using weighting schemes that incorporated both landline and cellphone modules in order to account for the variance in the probabilities (or likelihood) between modes of answering the telephone (“Comparability of Data BRFSS 2013 - compare\_2013.pdf,” n.d.). These methods help ensure the representative of the findings and implications.

Finally, the findings in this research add to the theoretical literature in innovative ways. The biopsychosocial model postulates that there is more to the relationship between gender and health behaviors than qualities immanent within the individual (Courtenay, 2013). Other factors – such as structural barriers and external social determinants – affect males and females differently. This research begins to parse out the barriers, which have been commonly associated with diabetes, in an effort to serve as guidance in the development of more gender-specific methods for creating programs aimed at reducing the burden of diabetes. The results provide the future interventionist with evidence of which

specific barriers in this research might need – and not need – to be accounted for in the tailoring of the intervention, and thus, saving the developers valuable time to focus on other barriers.

### **Limitations**

There are several limitations to this research. The BRFSS, for one, has modules, which are offered different years by different states. The diabetes module is offered in approximately 50% of the states any given year (26 states in 2014). This limits how representative it is of the nation as a whole, which has implications for the importance of this research regarding national policy debates. Another weakness is the method by which gender/sex is captured by the BRFSS. The respondent does not self-report sex or gender, but rather, it is up to the interviewer to determine whether the interviewee is male or female. This, of course, opens up this part of the survey to the biases of the interviewer. This limitation is particularly salient for this work given its purpose of determining the relevance of gender in the receipt of diabetes-specific care. The cross-sectional design limits attributing causation to the predictor variables. Moreover, the question assessing the presence of healthcare during the past year leaves open the possibility that the individual might have had insurance at some point. This also limits the accuracy of results. Finally, as with most surveys, the BRFSS is subject to recall bias in that – specific to this work – it is asking respondents how many times they visited their physician over the last 12 months for a specific condition. This can sometimes limit the accuracy of results.

### **Conclusions and Next Steps**

The strength of this research lies in its innovative approach to chronic illness research by adding to a growing body of research, which examines gender as a moderator between receipt of care and other barriers. This research moves the literature forward by documenting that males are at higher odds of not receiving the recommended level of diabetes care. It also shows that males who report not having insurance at some point during the year also are less likely (when compared to females) to receive the optimum level of care.

The barriers reported in this research, however, are only a few of the many that could have been investigated, which have been shown to affect the receipt of preventive services and healthcare. Future research could begin to examine other barriers to diabetes care and testing and examining approaches to increase positive outcomes and compliance with recommended care among patients. A next important step in research is to examine the relationship between gender/sex, presence/absence of health insurance plans, and diabetes and determine how ACA implementation impacts these findings. Such work might speak to the necessity of the expansion of Medicaid into those states as yet not expanded. Other external barriers such as lack of transportation and time-off work should also be considered. Intervention developers can utilize explanatory sequential designs, aimed at reaching the hard to reach male population. These designs first examine larger data sets and then, based on those results, develop qualitative instruments to further understand the relationships (Ivankova, Creswell, & Stick, 2006). Researchers could perform another set of regression analyses, incorporating many more barriers, to determine which – if any – stand out as predictors. Qualitative surveys could then be developed to inquire among a population of males if these are indeed salient obstacles, and if so, determine methods to circumvent them. Mixed methods research could help to even further understand reasons why males receive less beneficial healthcare than females. Another tactic could be to examine not only structural barriers and physician's visits, but those self-administered indicators – such as foot checks and diet – to determine if they vary by sex.

More specifically, the barrier of education could be examined more closely. The results from this study did not indicate that low education status was a barrier to diabetes-specific care for males. On the contrary, low education levels in the population indicated an increase in likelihood they would receive the optimum level of care. Conversely, those with a college education were less likely to receive the optimum level of care. This stands in opposition to some of the previous work cited in this study. Future

studies could dissect the population more closely to determine if education levels across race, ethnicity, and/or income vary in their effect on the receipt of care.

An unexamined covariate in this research is marital status. Males who are married, that is, have been shown to be more likely to report visiting a doctor in the last 12 months (“Products - Data Briefs - Number 154 - June 2014,” n.d.). Other research has shown that males with supportive partners are more likely to visit a physician than those who are not (Sloan, Conner, & Gough, 2015b). Marital status might have served as a moderator between sex and other covariates in the same way sex was expected to in the analyses. Future work could examine the issue from a more social support framework perspective in order to assess how the interaction between gender, barriers to care, and marital status affect the health of men and women differently.

Physician’s visits are an integral part of diabetes care. Individuals with diabetes are encouraged to visit their physician at least four times a year in order to avoid exacerbating their condition and developing more serious ailments. Those individuals who receive the optimum level of care are more likely to avoid complicating their condition. The purpose of this study was to examine the relationship between gender, accepted barriers to diabetes care, and the receipt of an optimum level of care in order to inform future efforts at secondary prevention in diabetes care. Research such as this furthers the field by offering evidence that males do indeed receive less optimum care for their diabetes when compared to females. Males also are less likely to visit their physician for their diabetes when also reporting not having health insurance during the past year. These findings demonstrate a need to focus on gender and the presence of health insurance when developing interventions and policy. Furthermore, by beginning to eliminate potential barriers for a specific gender, interventionists are afforded more time to examine other potential barriers, thus improving the potential for successful intervention development. Efforts such as these can potentially close the gender gap in diabetes care and ultimately reduce the burden of diabetes on the public health infrastructure.





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**Appendix A: Annotated SAS code**

```

libname brfss      "C:\output\";

%macro renameVar;
    rename ChkHemo3 = ChkHemo2
           Diabetes3 = Diabetes
           FluShot6 = FluShot
           _Hispanc = Hispanic
           PneuVac3 = pneumvac
           _Mrace1  = ORace
           _Age80   = Age
           PreDiab1=PreDiab
           _rfSmok3=_rfSmok2
           _Smoker3=_Smoker2
           ToldHi2=ToldHi
           BpHigh4=BpHigh
           ; /* rename */
%mend renameVar;

%macro Diabetes;
    if Diabetes3 eq 2 or /* Yes, but Pregnant */
    Diabetes3 eq 3 or /* No */
    Diabetes3 eq 4      /* Pre-Diabetes */
    then Diabetes3 = 2; /* No */
    Year = 2014;
%mend Diabetes;

*****;
data BRFSS2014Core;
    set BRFSS.LLCP2014 ( rename=( _LLCPWt =_FinalWt ));

    %renameVar
    %Diabetes
    run; /* data LLCP2014 */
data LLCP2014DiabetesModule;
    set BRFSS.LLCP2014 ( rename=( _LLCPWt =_FinalWt ));

    if _State eq 2 or /* Alaska */
    _State eq 4 or /* Arizona */
    _State eq 9 or /* Connecticut */
    _State eq 10 or /* Delaware */
    _State eq 11 or /* DC */
    _State eq 12 or /* FL */
    _State eq 13 or /* Georgia */
    _State eq 18 or /* Indiana */
    _State eq 19 or /* Iowa */

```

```

    _State eq 22 or /* Louisanna */
    _State eq 23 or /* Maine - the data is not in LLCPC but in
version 1 below */
    _State eq 28 or /* Mississippi */
    _State eq 34 or /* New Jersey */
    _State eq 35 or /* New Mexico */
    _State eq 38 or /* ND */
    _State eq 39 or /* Ohio */
    _State eq 45 or /* South Carolina */
    _State eq 46 or /* South Dakota */
    _State eq 47 or /* Tennessee */
    _State eq 51 or /* Virginia */
    _State eq 54 or /* West Virginia */
    _State eq 56 or /* Wyoming */
    _State eq 66 or /* Guam */
    _State eq 72; /* Puerto Rico */
run; /* data LLCPC2014DiabetesModule */

data LLCPC14V1;
    set brfss.LLCP14V1 ( rename=( _LCPWtV1 =_FinalWt ));

    if _State eq 31 or /* Nebraska */
    _State eq 48; /* Texas */
run; /* data LLCPC14V1 */

data BRFSS2014D;
    set LLCPC2014DiabetesModule
        LLCPC14V1
        ; /* set */

    %renameVar
    %Diabetes
run;

proc sort data=BRFSS2014d;
    by _ststr _psu;
run;

/*THIS IS WHERE YOU WILL CREATE ALL VARIABLES OF INTEREST
BEFORE RUNNING ANY ANALYSES*/
proc format;
    value care
        1='SubCare'
        2='OptCare'
        ;
    value sex
        1='Male'
        2='Female'
        ;

```

```

value race4catf
    1="White, NonHispanic"
    2="Black, NonHispanic"
    3="Other, NonHispanic"
    4="Hispanic"
;
value yesnof
    1='YES'
    2='NO'
;
value yesno2f
    1="YES"
    0="NO"
;
value edu4catf
    1="Not graduate high school"
    2="Graduated high school"
    3="Attended college or technical school"
    4="Graduated from College or Technical School"
;
value medcostf
    1="Did not see doctor because of cost"
    2="Cost had no effect on whether saw doctor"
;
value hlthplnf
    1="Did not have health insurance"
    2="Did have health insurance"
;

value incnewf
    1="Less than 10,000"
    2="10,000 to 14,999"
    3="15,000 to 19,999"
    4="20,000 to 24,999"
    5="25,000 to 34,999"
    6="35,000 to 49,999"
    7="50,000 to 74,999"
    8="75,000 or more"
;

run;

data brfss.brfss2014;
set brfss2014D;
where diabetes=1 and (Age GE 18 and Age LE 64);

if doctdiab=88 then Care=1;
else if doctdiab GE 1 and doctdiab LE 2 then Care=2;
else if doctdiab GE 3 then Care=3;

```

```

subpop=(diabetes=1 and (Age GE 18 and Age LE 64));

if doctdiab=88 then Care2CAT=1;
    else if doctdiab GE 1 and doctdiab LE 3 then Care2CAT=1;
    else if doctdiab GE 4 then Care2CAT=2;

/*medcostnew: 1=yes, 2=no - did not see doctor because of cost*/
if medcost in (1,2) then medcostnew=medcost;
    else medcostnew=.;

/*hlthplnnew: 1=yes, 2=no - did not have insurance*/
if hlthpln1=1 then hlthplnnew=2;
    else if hlthpln1=2 then hlthplnnew=1;
    else hlthplnnew=.;

/*Creating dummy variables for education
Ref: Graduate from college/technical school
NOHS: 1=yes, 2=no
HS: 1=yes, 2=no
GTHS: 1=yes, 2=no*/
if _educag NE 9 then
    do;
        if _educag=1 then NOHS=1;
            else NOHS=0;

        if _educag=2 then HS=1;
            else HS=0;

        if _educag=3 then GTHS=1;
            else GTHS=0;
    end;

if _educag NE 9 then
    do;
        edu4cat=_educag;
    end;

/*Variables to adjust for: age, race, gender, income, military
status*/

/*Age is good to go - no recoding necessary doofus*/

/*Race/Ethnicity - _RACE being DUMMY CODED*/
/*WHITE, NON-HISPANIC (_RACE=1) AS REFERENCE*/
if _RACE IN (1,2,3,4,5,6,7,8) THEN DO;
    IF _RACE=1 THEN WHITENH=1;
        ELSE WHITENH=0;
    IF _RACE=2 THEN BLACKNH=1;
        ELSE BLACKNH=0;

```

```

        IF _RACE IN (3,4,5,6,7) THEN OTHERNH=1;
            ELSE OTHERNH=0;
        IF _RACE=8 THEN HISPANIC=1;
            ELSE HISPANIC=0;
    END;
ELSE IF _RACE IN (9,.) THEN DO;
    WHITENH=.;
    BLACKNH=.;
    OTHERNH=.;
    HISPANIC=.;
END;

IF _RACE=1 THEN RACE4CAT=1;
    ELSE IF _RACE=2 THEN RACE4CAT=2;
    ELSE IF _RACE IN (3,4,5,6,7) THEN RACE4CAT=3;
    ELSE IF _RACE=8 THEN RACE4CAT=4;
ELSE RACE4CAT=.;

/*MILITARY STATUS - EVER SERVED ON ACTIVE DUTY*/
IF VETERAN3=1 THEN VETNEW=1;
    ELSE IF VETERAN3=2 THEN VETNEW=0;
ELSE VETNEW=.;

/*INCOME STATUS - */
IF INCOME2 IN (1,2,3,4,5,6,7,8) THEN INCNEW=INCOME2;
ELSE INCNEW=.;

format    Care2Cat care. sex sex.
          medcostnew medcostf. hlthplnnew hlthplnf. NOHS HS GTHS
yesno2f. edu4cat edu4catf.
          BLACKNH OTHERNH HISPANIC VETNEW YESNO2F. INCNEW INCNEWF.
          RACE4CAT RACE4CATF.;

run;

PROC FREQ DATA=brfss.brfss2014;
TABLES edu4cat*_educag;
RUN;

/*DESCRIPTIVE STATISTICS - YAY!*/
/*UNWEIGHTED CATEGORICAL DESCRIPTIVES*/
PROC FREQ DATA=brfss.brfss2014;
TABLES SEX RACE4CAT INCNEW VETNEW MEDCOSTNEW HLTHPLNNEW;
RUN;
PROC FREQ DATA=brfss.brfss2014;
TABLES    SEX*(RACE4CAT VETNEW)
          MEDCOSTNEW*(RACE4CAT INCNEW VETNEW)
          HLTHPLNNEW*(RACE4CAT INCNEW VETNEW)/CHISQ;
RUN;

```

```

PROC FREQ DATA=brfss.brfss2014;
TABLES SEX*(MEDCOSTNEW HLTHPLNNEW );
RUN;
/*WEIGHTED CATEGORICAL DESCRIPTIVES*/
PROC SURVEYFREQ DATA=brfss.brfss2014;
    weight _finalwt;
    strata _state;
    cluster _psu;
    TABLES SEX RACE4CAT INCNEW VETNEW MEDCOSTNEW HLTHPLNNEW;
RUN;
PROC SURVEYFREQ DATA=brfss.brfss2014;
    weight _finalwt;
    strata _state;
    cluster _psu;
    TABLES      SEX*(RACE4CAT VETNEW)
                MEDCOSTNEW*(RACE4CAT INCNEW VETNEW)
                HLTHPLNNEW*(RACE4CAT INCNEW VETNEW)/CHISQ;
RUN;

/*MEANS AND STANDARD DEVIATION OF AGE BY SEX*/
/*UNWEIGHTED*/
PROC SORT DATA=brfss.brfss2014;
    BY SEX;
RUN;
PROC UNIVARIATE DATA=brfss.brfss2014;
    BY SEX;
    VAR AGE;
RUN;
PROC GLM DATA=brfss.brfss2014;
    CLASS SEX;
    MODEL AGE=SEX;
RUN;
/*WEIGHTED*/
PROC SURVEYMEANS DATA=brfss.brfss2014;
    weight _finalwt;
    strata _state;
    cluster _psu;
    BY SEX;
    VAR AGE;
RUN;
PROC SURVEYREG DATA=brfss.brfss2014;
    weight _finalwt;
    strata _state;
    cluster _psu;
    class sex ;*(ref = LAST) / param = ref;
    MODEL AGE=SEX;
RUN;

```

```

/*ANALYSIS FOR CRUDE AND ADJUSTED ODDS WITH COVARIATES OF INTEREST*/
/*1. 120916 Initial results showing males have 1.255 times the odds
of seeking suboptimal care*/
proc surveylogistic data=brfss.brfss2014;
    weight _finalwt;
    strata _state;
    cluster _psu;
    class sex (ref = first) / param = ref;
    model care2CAT (event=last)=sex / link=logit;
run;

/*ADJUSTED ODDS WITH COVARIATES*/
/*NO IVS OF INTEREST EXCEPT FOR SEX*/
PROC SORT DATA=brfss.brfss2014;
    BY SEX BLACKNH OTHERNH HISPANIC VETNEW INCNEW;
RUN;
proc surveylogistic data=brfss.brfss2014;
    weight _finalwt;
    strata _state;
    cluster _psu;
    class sex (REF=FIRST) BLACKNH (REF=FIRST) OTHERNH (REF=FIRST)
HISPANIC (REF=FIRST) VETNEW (REF=FIRST) INCNEW (REF="75,000 or more")
/ param = ref;
    model care2CAT (event=last)=sex AGE BLACKNH OTHERNH HISPANIC
VETNEW INCNEW/ link=logit;
run;
/*MEDICAL COST*/
PROC SORT DATA=brfss.brfss2014;
    BY SEX MEDCOSTNEW BLACKNH OTHERNH HISPANIC VETNEW INCNEW;
RUN;
proc surveylogistic data=brfss.brfss2014;
    weight _finalwt;
    strata _state;
    cluster _psu;
    class sex (REF=FIRST) MEDCOSTNEW (REF=FIRST) BLACKNH
(REF=FIRST) OTHERNH (REF=FIRST) HISPANIC (REF=FIRST) VETNEW
(REF=FIRST) INCNEW (REF="75,000 or more") / param = ref;
    model care2CAT (event=last)=sex MEDCOSTNEW AGE BLACKNH OTHERNH
HISPANIC VETNEW INCNEW/ link=logit;
run;
proc surveylogistic data=brfss.brfss2014;
    weight _finalwt;
    strata _state;
    cluster _psu;
    class sex (REF=FIRST) MEDCOSTNEW (REF=FIRST) BLACKNH
(REF=FIRST) OTHERNH (REF=FIRST) HISPANIC (REF=FIRST) VETNEW
(REF=FIRST) INCNEW (REF="75,000 or more") / param = ref;

```



```

    model care2CAT (event=last)=sex MEDCOSTNEW SEX*MEDCOSTNEW AGE
    BLACKNH OTHERNH HISPANIC VETNEW INCNEW/ link=logit;
run;

/*HEALTH PLAN*/
PROC SORT DATA=brfss.brfss2014;
    BY SEX HLTHPLNNEW BLACKNH OTHERNH HISPANIC VETNEW INCNEW;
RUN;
proc surveylogistic data=brfss.brfss2014;
    weight _finalwt;
    strata _state;
    cluster _psu;
    class sex (REF=FIRST) HLTHPLNNEW (REF=FIRST) BLACKNH
    (REF=FIRST) OTHERNH (REF=FIRST) HISPANIC (REF=FIRST) VETNEW
    (REF=FIRST) INCNEW (REF="75,000 or more") / param = ref;
    model care2CAT (event=last)=sex HLTHPLNNEW AGE BLACKNH OTHERNH
    HISPANIC VETNEW INCNEW/ link=logit;
run;
proc surveylogistic data=brfss.brfss2014;
    weight _finalwt;
    strata _state;
    cluster _psu;
    class sex (REF=FIRST) HLTHPLNNEW (REF=FIRST) BLACKNH
    (REF=FIRST) OTHERNH (REF=FIRST) HISPANIC (REF=FIRST) VETNEW
    (REF=FIRST) INCNEW (REF="75,000 or more") / param = ref;
    model care2CAT (event=last)=sex HLTHPLNNEW SEX*HLTHPLNNEW AGE
    BLACKNH OTHERNH HISPANIC VETNEW INCNEW/ link=logit;
run;

/*EDUCATION*/
PROC SORT DATA=brfss.brfss2014;
    BY SEX NOHS HS GTHS BLACKNH OTHERNH HISPANIC VETNEW INCNEW;
RUN;
proc surveylogistic data=brfss.brfss2014;
    weight _finalwt;
    strata _state;
    cluster _psu;
    class sex (REF=FIRST) NOHS (REF=FIRST) HS (REF=FIRST) GTHS
    (REF=FIRST) BLACKNH (REF=FIRST) OTHERNH (REF=FIRST) HISPANIC
    (REF=FIRST) VETNEW (REF=FIRST) INCNEW (REF="75,000 or more") / param
    = ref;
    model care2CAT (event=last)=sex NOHS HS GTHS AGE BLACKNH OTHERNH
    HISPANIC VETNEW INCNEW/ link=logit;
run;
proc surveylogistic data=brfss.brfss2014;
    weight _finalwt;
    strata _state;
    cluster _psu;

```

```

class sex (REF=FIRST) NOHS (REF=FIRST) HS (REF=FIRST) GTHS
(REF=FIRST) BLACKNH (REF=FIRST) OTHERNH (REF=FIRST) HISPANIC
(REF=FIRST) VETNEW (REF=FIRST) INCNEW (REF="75,000 or more") / param
= ref;
model care2CAT (event=last)=sex NOHS HS GTHS NOHS*SEX HS*SEX
GTHS*SEX AGE BLACKNH OTHERNH HISPANIC VETNEW INCNEW/ link=logit;
run;

```

/\*REMOVING INCOME FROM THE MODEL\*/

```

proc surveylogistic data=brfss.brfss2014;
weight _finalwt;
strata _state;
cluster _psu;
class sex (REF=FIRST) BLACKNH (REF=FIRST) OTHERNH (REF=FIRST)
HISPANIC (REF=FIRST) VETNEW (REF=FIRST) / param = ref;
model care2CAT (event=last)=sex AGE BLACKNH OTHERNH HISPANIC
VETNEW / link=logit;
run;

```

```

proc surveylogistic data=brfss.brfss2014;
weight _finalwt;
strata _state;
cluster _psu;
class sex (REF=FIRST) MEDCOSTNEW (REF=FIRST) BLACKNH
(REF=FIRST) OTHERNH (REF=FIRST) HISPANIC (REF=FIRST) VETNEW
(REF=FIRST) /param = ref;
model care2CAT (event=last)=sex MEDCOSTNEW SEX*MEDCOSTNEW AGE
BLACKNH OTHERNH HISPANIC VETNEW/ link=logit;
run;

```

```

proc surveylogistic data=brfss.brfss2014;
weight _finalwt;
strata _state;
cluster _psu;
class sex (REF=FIRST) HLTHPLNNEW (REF=FIRST) BLACKNH
(REF=FIRST) OTHERNH (REF=FIRST) HISPANIC (REF=FIRST) VETNEW
(REF=FIRST) / param = ref;
model care2CAT (event=last)=sex HLTHPLNNEW SEX*HLTHPLNNEW AGE
BLACKNH OTHERNH HISPANIC VETNEW / link=logit;
run;

```

```

proc surveylogistic data=brfss.brfss2014;
weight _finalwt;
strata _state;
cluster _psu;
class sex (REF=FIRST) NOHS (REF=FIRST) HS (REF=FIRST) GTHS
(REF=FIRST) BLACKNH (REF=FIRST) OTHERNH (REF=FIRST) HISPANIC
(REF=FIRST) VETNEW (REF=FIRST) / param = ref;

```

```

    model care2CAT (event=last)=sex NOHS HS GTHS NOHS*SEX HS*SEX
    GTHS*SEX AGE BLACKNH OTHERNH HISPANIC VETNEW/ link=logit;
run;

```

```

/*INTERACTION WITH RACE/ETHNICITY*/
proc surveylogistic data=brfss.brfss2014;
    weight _finalwt;
    strata _state;
    cluster _psu;
    class sex (REF=FIRST) BLACKNH (REF=FIRST) OTHERNH (REF=FIRST)
    HISPANIC (REF=FIRST) VETNEW (REF=FIRST) / param = ref;
    model care2CAT (event=last)=sex AGE BLACKNH OTHERNH HISPANIC
    SEX*BLACKNH SEX*OTHERNH SEX*HISPANIC VETNEW / link=logit;
run;

```

```

/*2a. By medical cost:
Overall: 1.33
Men: 1.22 (not significant)
Women:1.49*/
proc sort data=brfss.brfss2014;
    by _ststr _psu sex;
run;

```

```

proc surveylogistic data=brfss.brfss2014;
    weight _finalwt;
    strata _state;
    cluster _psu;
    class medcostnew (ref = first) / param = ref;
    model care2CAT (event=last)=medcostnew / link=logit;
run;

```

```

proc surveylogistic data=brfss.brfss2014;
    weight _finalwt;
    strata _state;
    domain sex;
    cluster _psu;
    class medcostnew (ref = first) / param = ref;
    model care2CAT (event=last)=medcostnew / link=logit;
run;

```

```

proc surveylogistic data=brfss.brfss2014;
    weight _finalwt;
    strata _state;

    *    domain sex;
    cluster _psu;
    class sex (ref = first) medcostnew (ref = first) / param = ref;
    model care2CAT (event=last)=sex medcostnew sex*medcostnew /
link=logit;

```

```

run;

/*2b. By insurance:
Overall: 2.01
Men: 2.59
Women: 1.65*/
proc sort data=brfss.brfss2014;
    by _ststr _psu sex;
run;

proc surveylogistic data=brfss.brfss2014;
    weight _finalwt;
    strata _state;
    cluster _psu;
    class hlthplnnew (ref = first) / param = ref;
    model care2CAT (event=last)=hlthplnnew / link=logit;
run;

proc surveylogistic data=brfss.brfss2014;
    weight _finalwt;
    strata _state;
    domain sex;
    cluster _psu;
    class hlthplnnew (ref = first) / param = ref;
    model care2CAT (event=last)=hlthplnnew / link=logit;
run;

proc surveylogistic data=brfss.brfss2014;
    weight _finalwt;
    strata _state;

    *    domain sex;
    cluster _psu;
    class sex (ref = first) hlthplnnew (ref = first) / param = ref;
    model care2CAT (event=last)=sex hlthplnnew sex*hlthplnnew /
link=logit;
run;

/*2c. By education:
Overall:
Men:
Women: */
proc sort data=brfss.brfss2014;
    by _ststr _psu sex;
run;

proc surveylogistic data=brfss.brfss2014;
    weight _finalwt;
    strata _state;

```

```

    cluster _psu;
    class NOHS (ref = first) HS (ref = first) GTHS (ref = first) /
param = ref;
    model care2CAT (event=last)=NOHS HS GTHS / link=logit;
run;

proc surveylogistic data=brfss.brfss2014;
    weight _finalwt;
    strata _state;
    domain sex;
    cluster _psu;
    class NOHS (ref = first) HS (ref = first) GTHS (ref = first) /
param = ref;
    model care2CAT (event=last)=NOHS HS GTHS / link=logit;
run;

proc surveylogistic data=brfss.brfss2014;
    weight _finalwt;
    strata _state;

    *    domain sex;
    cluster _psu;
    class sex (ref = first) NOHS (ref = first) HS (ref = first) GTHS
(ref = first) / param = ref;
    model care2CAT (event=last)=sex NOHS HS GTHS sex*NOHS sex*HS
sex*GTHS / link=logit;
run;

/*3. Initial model:
Overall:
Men:
Women: */
proc sort data=brfss.brfss2014;
    by _ststr _psu sex;
run;

proc surveylogistic data=brfss.brfss2014;
    weight _finalwt;
    strata _state;
    cluster _psu;
    class sex (ref = first) medcostnew (ref = first) hlthplnnew (ref
= first) NOHS (ref = first) HS (ref = first) GTHS (ref = first) /
param = ref;
    model care2CAT (event=last)=sex medcostnew hlthplnnew NOHS HS
GTHS / link=logit;
run;

proc surveylogistic data=brfss.brfss2014;
    weight _finalwt;

```

```

    strata _state;

    *    domain sex;
    cluster _psu;
    class sex (ref = first) medcostnew (ref = first) hlthplnnew (ref
= first) NOHS (ref = first) HS (ref = first) GTHS (ref = first) /
param = ref;
    model care2CAT (event=last)=sex medcostnew hlthplnnew NOHS HS
GTHS sex*medcostnew sex*hlthplnnew sex*NOHS sex*HS sex*GTHS /
link=logit;
run;

/*
proc surveylogistic data=brfss.brfss2014;
weight _finalwt;
strata _state;
domain subpop;
cluster _psu;
class sex (ref = first) / param = ref;
model care2CAT (event=last)=sex / link=logit;
run;
*/
proc freq data=brfss.brfss2014;
    tables medcost*medcostnew
           hlthpln1*hlthplnnew _educag*(NOHS HS GTHS);
run;

proc freq data=brfss.brfss2014;
    tables subpop;
run;

/*DICHOTOMOUS CARE CATEGORIZATION*/
/*create subpop*care2cat*sex; created subpop to ensure full pop was
included to correct standard errors*/
proc surveyfreq data=brfss.brfss2014;
    *where sex=2;
    weight _finalwt;
    strata _state;
    cluster _psu;
    tables subpop*sex*care2CAT/chisq wchisq;

    */
    out=gender2014;
run;

```

***Appendix B: Hypotheses and BRFSS questions***

H<sub>1</sub>: Among persons of working age self-reporting a diabetes diagnosis, the odds of not receiving diabetes specific preventive services will be greater for those who report being males (Please consider to rephrase as: adult males with self-report diagnosed diabetes have less odds to receive diabetes care and control services than female counterparts) .

**BRFSS item:**

**Module 16: Sexual Identity and Gender Orientation**

**Adult Random Selection**

I need to randomly select one adult who lives in your household to be interviewed. How many members of your household, including yourself, are 18 years of age or older?

\_\_ Number of If "1,"

Are you the adult?

If "yes,"

Then you are the person I need to speak with. Enter 1 man or 1 woman below (Ask gender if necessary).

**Go to page 6.**

If "no,"

Is the adult a man or a woman? Enter 1 man or 1 woman below. May I speak with [fill in (him/her) from previous question]? **Go to "correct respondent" on the next page.**

**[Optional] Module 2: Diabetes**

**4.** About how many times in the past 12 months have you seen a doctor, nurse, or other health professional for your diabetes?

\_\_ Number of times [76 = 76 or more]

8 8 None

7 7 Don't know / Not sure

9 9 Refused

**Secondary Hypothesis 1:**

H<sub>1A</sub>: Having insurance during the past 12 months is associated with greater odds of receiving diabetes prevention services.

H<sub>1B</sub>: Males who report not having insurance coverage in the past 12 months will have greater odds of not receiving diabetes-specific preventive services than females.

**BRFSS Item[s]:**

**Module 4: Healthcare Access**

**4a.** In the PAST 12 MONTHS was there any time when you did NOT have ANY health insurance or coverage?

1 Yes [Go to Q5]

2 No [Go to Q5]

7 Don't know/Not sure [Go to Q5]

9 Refused [Go to Q5]

**CATI Note: If Q3.1 = 2, 7, or 9 continue, else go to next question (Q5).**

**[Optional] Module 2: Diabetes**

**4.** About how many times in the past 12 months have you seen a doctor, nurse, or other health professional for your diabetes?

\_\_ Number of times [76 = 76 or more]

8 8 None

7 7 Don't know / Not sure

9 9 Refused

**Secondary Hypothesis 2:**

H<sub>2A</sub>: Not foregoing seeing a doctor during the past 12 months due to cost is associated with greater odds of receiving diabetes prevention services.

H<sub>2B</sub>: The odds of receiving diabetes prevention services among persons who did not forego seeing a doctor during the past 12 months due to cost is lower for males than females.

**BRFSS item[s]:**

**Module 4: Healthcare Access**

**3.3** Was there a time in the past 12 months when you needed to see a doctor but could not because of cost?

1 Yes

2 No

7 Don't know / Not sure

9 Refused

**[Optional] Module 2: Diabetes**



4. About how many times in the past 12 months have you seen a doctor, nurse, or other health professional for your diabetes?

\_\_ Number of times [76 = 76 or more]

8 8 None

7 7 Don't know / Not sure

9 9 Refused

### **Secondary Hypothesis 3:**

H<sub>3A</sub>: Higher education is associated with greater odds of receiving diabetes prevention services.

H<sub>3B</sub>: The odds of receiving diabetes prevention services among persons with higher education is greater for males than females.

**8.8** What is the highest grade or year of school you completed?

#### **Read only if necessary:**

1 Never attended school or only attended kindergarten

2 Grades 1 through 8 (Elementary)

3 Grades 9 through 11 (Some high school)

4 Grade 12 or GED (High school graduate)

5 College 1 year to 3 years (Some college or technical school)

6 College 4 years or more (College graduate)

### **[Optional] Module 2: Diabetes**

4. About how many times in the past 12 months have you seen a doctor, nurse, or other health professional for your diabetes?

\_\_ Number of times [76 = 76 or more]

8 8 None

7 7 Don't know / Not sure

9 9 Refused

The above list represents the survey instrument, and the questions derived from it, which will be used in the conducting of this research. SAS Version 9.3, will be used to run the logistic regression for the primary hypothesis as well as the potential moderator analyses. The analytic design is discussed in the next chapter.

